A MODEL FOR TRAINING THE DISADVANTAGED: TAT AT OAK RIDGE, TENN.

MANPOWER RESEARCH MONOGRAPH NO. 29

U. S. DEPARTMENT OF LABOR

Manpower Administration

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Peter J. Brennan, Secretary
Manpower Administration

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PREFACE

This report describes the Training and Technology (TAT) Program, which has been conducted since 1966 by Oak Ridge Associated Universities (ORAU) and the Nuclear Division, Union Carbide Corporation, at the U.S. Atomic Energy Commission's Oak Ridge Y-12 plant. Financial support for the project has come from funds provided by the Manpower Development and Training Act—administered by the U.S. Departments of Labor and Health, Education, and Welfare—and from the Atomic Energy Commission.

In the TAT program, a group of mostly young, disadvantaged individuals has been trained by craftsmen in a setting similar to "real-life" working conditions in a factory. Requests for more detailed information about TAT, an industry-government training partnership helping to meet the Nation's needs for skilled industrial manpower, may be addressed to:

Training and Technology
P.O. Box 117
Oak Ridge, Tennessee 37830

The report was prepared by Mary F. Davies, Manpower Analyst in the Office of Policy, Evaluation, and Research, with the cooperation of Charles Phillips and Richard McAllister and under the general direction of Dr. Howard Rosen, Chief, Office of Research and Development.

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INTRODUCTION

At a conference held in Washington, D.C., in March 1972 to celebrate the 10th anniversary of the Manpower Development and Training Act (MDTA), participants discussed the unfinished agenda of national manpower problems as well as the specifics of program activities under MDTA. They were concerned with manpower policy and programs as instruments of social change and with the role of manpower training in easing economic downturns, inflationary pressures, and poverty. In the opening address, the Secretary of Labor acknowledged that manpower specialists had yet to reach consensus on three basic questions: What should be done? What is the best way to do it? How well are we doing it so far? Among the troublesome "how to do it" questions cited at the conference were: Who should be doing what? Under whose guidance and control? With whose money? With what kinds of approaches and techniques?

This report is being offered because 7 years of experience in the Training and Technology (TAT) Program located at Oak Ridge, Tenn., have provided some cogent answers to queries concerning the "best way" to provide effective skill training to the disadvantaged.

Within the limits of its small scale of operations, TAT has mobilized the resources of private industry and government agencies:

(1) To meet employer demand for technical workers in a manner that has important implications for efficient production and reduced inflationary pressures.

(2) To move potential members of the secondary labor force of low-paid casual workers into the primary labor force of self-supporting, stably employed workers, with beneficial side effects in the form of increased tax returns and consumer demand.

(3) To improve human resource utilization through training of the rural poor, inner-city blacks, dropout-prone youth, and other disadvantaged groups. Pressures generating delinquent behavior have also been lessened.

(4) To serve the objective of equal employment opportunity, thereby reducing racial tensions.

(5) To enrich individual lives—not only those of the trainees but those of their families and friends.

In addition to an innovative approach to skill training, TAT has achieved the often elusive goal of identifying industry's needs for trained manpower on the one hand and a trainable supply of workers on the other. By no means does the vocational training program meshing the two offer a total solution to problems of unemployment and the limited access of the disadvantaged[1] to jobs in the primary labor market. However, the program has brought into being an industrial training center serving a number of Atomic Energy Commission contractors in the eastern United States as well as many other employers. The job skills taught are those either generally in strong demand in modern, technology-based industry or specifically required by employers hiring TAT graduates. Graduates are prepared to perform a variety of machining and mechanical operations and other technical job assignments.

The fact that TAT training is in these occupations—for which starting wages are relatively high—goes far toward accounting for TAT's unusual "success rate." Over 90 percent of the more than 2,000 TAT graduates

[1] For manpower program purposes the Department of Labor defines a disadvantaged person as one who is poor, lacks suitable employment, and is either (1) a school dropout, (2) a member of a minority group, (3) under 22 years of age, (4) 45 years of age or over, or (5) handicapped. Members of families receiving cash welfare payments are deemed poor, as well as those who, according to the latest poverty guidelines established by the Department of Health, Education, and Welfare, are members of nonfarm families of four with incomes under $4,200 or farm families of four with incomes under $3,575. The critical income level is, of course, adjusted for size of family.

(from September 1967 through March 1973) were placed in industrial jobs at an average wage of $3 an hour. Graduates in 1972 started work at an average $3.29 per hour, which translates into annual wages of nearly $7,000–substantially more than the $2.49-per-hour average of all MDTA institutional trainees who completed training and were placed in jobs in fiscal 1972.

Moreover, TAT's dropout rate has been low; over the 6 years ending with 1972 it averaged 18 percent. In the last of these years it was 21 percent, as against 28 percent for MDTA institutional training.

TAT's record has been achieved at a cost that compares favorably with that for MDTA institutional training. For the 1971-72 training year, the average cost of *graduating* a TAT trainee was approximately $3,900, compared with MDTA's fiscal 1972 cost of $3,700 per completer; but, with higher attrition between completion and placement, MDTA training cost per *placement* amounted to $4,900, while TAT's per-placement cost was $4,500.

Why is TAT succeeding better than most manpower programs offering similar services? The explanation encompasses a number of factors, beginning with the industrial setting and the related ability of the staff to combine the best elements of institutional and on-the-job training, and continuing with these items:

–Instructors are craftsmen, with current industrial experience.

–A painstaking recruitment/selection process, reflecting consistent emphasis on job development and placement, engages all members of the staff, regardless of specialized responsibilities.

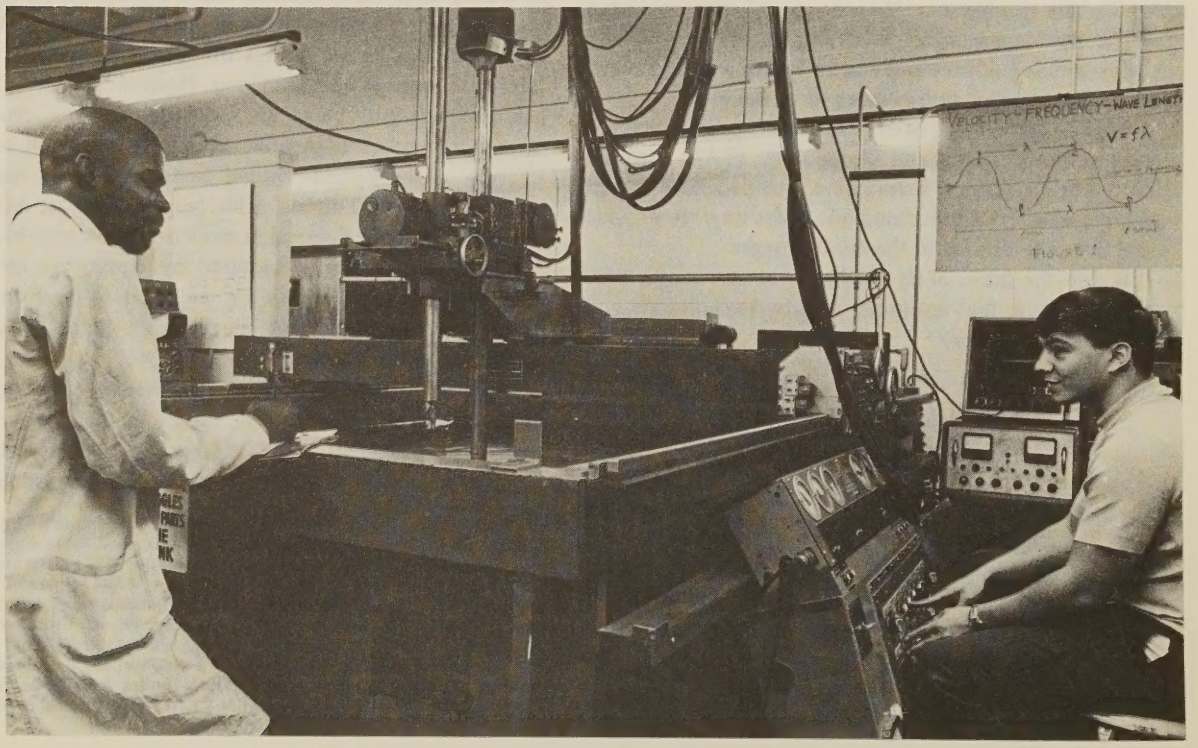
–Shop training is rigorous, relatively lengthy, and, at the same time, flexible and individualized.

–Careful attention is given to trade-related academic instruction and, as needed, to remedial education.

–Program staff members have close relationships with a group of employers (AEC contractors) whose skill needs are known to them, and they have developed a larger placement network of satisfied employers by following up leads on job openings and tailoring training to fit those openings.

–Comprehensive supportive services smooth the way for trainees and usually prevent crises from arising. Counselors systematically monitor trainees' progress.

–Indepth union and community support have been mobilized.



–Strong management and professional program development services free the training staff to concentrate on training.

The key to TAT's effectiveness is perhaps the fact that industry and government have formed a partnership to train and place the unemployed and underemployed, combining private and public resources in the three fundamental components of the project:

(1) The industrial facilities and personnel of the U.S. Atomic Energy Commission's Oak Ridge nuclear production and research complex, operated for the AEC by the Nuclear Division, Union Carbide Corporation.

(2) The program development and administrative capabilities provided by Oak Ridge Associated Universities (ORAU), sponsored by 43 colleges and universities in the South to carry out educational and research programs under contract with the AEC.

(3) The financial support provided (primarily) by the Manpower Development and Training Act of 1962–administered by the Departments of Labor and Health, Education, and Welfare–and by the AEC and other, varied sources.

All of these elements in the success of the TAT program will be described in detail in subsequent sections of this report.

There is reason to believe that the TAT model can be applied in other areas and industrial contexts, especially within the new policy framework of "manpower revenue sharing."[2] The increasing diversity in trainee groups and employers served by TAT, the widening of geographic areas from which recruits are drawn and to which graduates move for jobs, and innovations in handling costs of training and subsistence allowances all suggest that the TAT model may be well suited to the manpower revenue sharing era. Prime sponsors (responsible for planning and managing manpower programs for States and localities) will be seeking effective ways of organizing resources and proven techniques for providing services.

Movement toward replication of the TAT model is described, and the possibility for its wider application explored, in the final section.

[2] Under revenue sharing, elected State and local officials will have enlarged responsibility for planning and operating manpower programs, and national categorical programs with rigid eligibility requirements and procedures will be deemphasized.

I. PROGRAM ACCOMPLISHMENTS

About a third of TAT graduates have been employed in the local plant of Union Carbide, the company which provides the training, or by other AEC contractors, while more than 60 additional employers—including the Tennessee Valley Authority, a large shipbuilder in Virginia, and a large local construction firm—have hired the remaining two-thirds. A number of graduates have been placed in faraway job locales, including Houston, Ft. Worth, Anaheim, Calif., Chicago, Providence, St. Louis, New Orleans, Pascagoula, Miss., and Tampa. A few graduates have moved into maintenance work in such nonindustrial settings as universities and city governments.

Training Outcomes

The 392 TAT graduates in the 1971-72 training year brought the total to 1,855, or 82 percent of the 2,258 persons enrolled since the start of the program. Based on the records of the last 3 years, only about a third of those who fail to graduate are dismissed for cause, while decisions to enter the Armed Forces or schools account for about 5 percent. Personal reasons and illness also take a toll, but the overall record compares favorably with most manpower programs.

Practically all of the graduates available for placement move immediately into jobs at *starting* salaries close to the national *average* for production workers. Their post-program wages have been sharply above the near-poverty-level wages of the 2 in 5 graduates who were employed immediately before entering the program.

Table 1 summarizes this TAT record year by year.

A comparison of a portion of the TAT record for 1972 with that of MDTA institutional training and the Job Corps—a comparison not wholly warranted since there are significant differences among the programs, their enrollees, and in the way data were collected—spotlights the TAT success. TAT posted by far the highest completion rates, and the post-training wages of its graduates were substantially higher than those of MDTA completers and Job Corps terminees:

Program[1]	*Terminations*	*Percent who Completed*	*Were placed*	*Average hourly wage*[2]
TAT	476	82	72	$3.29
MDTA Institutional	153,800	72	53	2.49
Job Corps	48,600	57	72[3]	1.95

[1] Data for the MDTA institutional and Job Corps programs relate to fiscal 1972, while the training year for TAT ends with September.

[2] On first post-training job.

[3] Includes terminees who failed to complete training but were employed, or had returned to school or entered the Armed Forces.

However, more than a third of the MDTA institutional trainees and about a fourth of the Job Corps trainees were women, compared with only 5 percent of TAT trainees. Job Corps enrollees were all under 21 years of age. The prevailing wage differential favoring men and adults is undoubtedly a factor in the higher average wage of TAT trainees.

Earnings Gains

Although such data are difficult and expensive to obtain, changes in pre- to post-training annual earnings

TABLE 1. SUMMARY OF TAT ENROLLMENTS, GRADUATES, PLACEMENTS, AND GRADUATE WAGES, BY TRAINING YEARS ENDING EACH SEPTEMBER, 1967-72

Item	Total	Year				
		1972	1971	1970	1969	1967 and 1968[1]
Enrollees	2,258	476	379	393	386	624
Graduates	1,855	392	271	328	339	525
Available for placement	1,742	365	253	315	333	476
Placed	1,677	341	241	297	325	473
Percent	96	93	95	94	97	99
Average hourly wage:						
TAT graduates (starting wage)		$3.29	$3.15	$3.09	$3.03	$2.85
All production workers[2]		$3.65	$3.42	$3.22	$3.04	$2.70
Annual post-training earnings[3]		$6,830	$6,540	$6,427	$6,302	$5,928
Annual pre-training earnings[3]		$4,526	$3,778	$3,661	$3,349	([4])
Percent with pre-training earnings	39	30	39	30	28	58

[1] The 2-year experimental and demonstration period.
[2] National annual averages of production workers on private payrolls, U.S. Department of Labor, Bureau of Labor Statistics.
[3] Assumes 2,080 hours of work.
[4] Data not available.

offer a significant measure of the extent to which a manpower program expands the opportunities of its enrollees and enables them to compete more effectively in the job market.

The estimated average annual wage gain of TAT graduates who were employed when they entered training varies from about $2,300 for the 1972 classes to over $2,900 for 1969 graduates.[1] Adding in the "zero" earnings of those not employed before training more than doubles the wage gains. (While exclusion of the "zero cases" from the computation would understate the wage gains, including them would overstate the increases, to the extent that those unemployed at time of entry into training had at least some earnings during the preceding year.)

Increases in earnings of TAT participants are substantially larger than those of MDTA institutional enrollees, as shown by the findings from an evaluation study in which a national sample of MDTA trainees enrolled in 1969 gained $1,876 in estimated annual earnings between the 16-month pre- and post-training periods.[2] However, even after this substantial improvement, the average enrollee was earning only $3,400, near the top range of poverty incomes. The sample was comprised of 61 percent whites, 37 percent blacks, and the remainder, other racial and ethnic minorities. Just over half were women; 53 percent had less than a high school education. This study also lacked a comparison group, but had the advantage over TAT data of longitudinal information on employment before and after training to be used in computing wage gains.

However, with resources provided by the Department of Labor under interagency agreements with the Atomic Energy Commission, the ORAU-TAT staff undertook a followup study, interviewing a random, stratified sample of 472 of the more than 1,600 graduates through March 1972, along with a sample of their employers. The study provides assurance that TAT graduates maintained a high level of post-program employment, at rising wages.

Post-Training Experience of Graduates

Stable, Work-Related Employment. At the time of the survey, TAT graduates were earning an average $3.35

[1] The available data are somewhat flawed, since estimates of pre- and post-training earnings of TAT graduates (table 1) assume that their employment experiences immediately before and immediately after training persisted for an entire year. Another shortcoming is the absence of a comparison group to isolate the effect of training from such other influences as increased age and experience and generally rising wage rates. However, the wage increases of TAT graduates are so large that there seems to be no doubt that the program was a critical factor in increased earnings.

[2] *MDTA Outcomes Study, Final Report*, Decision Making Information, Santa Ana, Calif., November 1971. Individuals with no pre-training earnings are included in this calculation. If only those with pre- *and* post-training earnings are included, the annual earnings gain falls to $841.

per hour. Their unemployment rate was 9 percent, low for a group of young workers of whom a majority were unemployed before training. On the whole, they had worked 90 percent of the time since graduation. They were stable employees, with nearly two-thirds still in their first post-training firms; 23 percent had held two jobs, 13 percent had held three or more, and less than 2 percent had had no job at all. Many were found to be continuing their training in company-sponsored programs.

No meaningful analysis of the amount of wage gain since entering on the first job was possible because of the wide variation in the length of time the graduates surveyed had been in the work force. However, the majority who held only one job had averaged 18 months' tenure in that job; and their average hourly wage increase of 71 cents (24 percent) to $3.69 an hour indicates substantial upward movement in earnings. While a portion of this increase may reflect general cost-of-living wage gains, more of it may reasonably be ascribed to merit raises and promotions.

Nearly two-thirds of the graduates reported that their work was related to their training—a possible understatement because of the fairly common practice in industry of starting new workers in a labor pool from which they later move to more specific work assignments. Some relatively new, unsophisticated workers may have failed to perceive training-relatedness under these circumstances. Nevertheless, the data show that starting wages were highest for those reporting job duties closely related to training, slightly lower for those with job duties partly related to training, and significantly lower for those whose duties were seen as unrelated to training.

Duties related to training	*Percent of graduates*	*Average hourly starting wage*
Closely	53	$3.03
Partly	10	2.95
Unrelated	37	2.51

These findings, and the likelihood that on-the-job use of the training skill will boost long-range earnings potential, emphasize the importance of relating training to employer demands and of followthrough in the placement effort.

Job Satisfaction and Job Adjustment. A high degree of job satisfaction (generally regarded as an indication of job commitment) was expressed by the graduates. Eighty-six percent said they liked their first jobs and 14 percent disliked them, with 17 percent at the positive ("very much") end of the scale and 3 percent at the negative. They were also questioned about satisfaction with pay and with coworkers, supervisors, employing company, unions, and duties. The attitudes revealed were generally positive, with the greatest satisfaction related to the interpersonal aspects of the job.

Job adjustment problems were also a subject of inquiry. Sixty-two percent of the graduates reported no problems; and of those who experienced problems, about a third said they were annoying rather than serious. Problems directly related to the job (e.g., shift work, difficulty of the job, conflicts with coworkers, and discrimination) accounted for nearly 60 percent of the problems reported, while such personal problems as finances, housing, and transportation were less frequently reported. (In contrast to the graduates, the limited number of supervisors from whom responses were obtained saw over half the problems in terms of absenteeism, illness, and tardiness. They attributed a relatively insignificant 10 percent of the problems to lack of skill.)

Graduates who moved to new communities to take their first jobs—about a quarter of the total—reported a high incidence of problems concerning relocation. About two-thirds experienced problems in finding suitable housing, assuming the expenses of moving, and overcoming homesickness. No norms have been established which would make it possible to determine whether this is in line with, or more serious than, the experience of other groups relocating under similar circumstances.

Supervisors' ratings of TAT graduates placed them somewhat above average in overall job performance. Forty-two percent were rated above average, 45 percent as average, and only 13 percent as below average. These ratings showed no significant association with pay rates, but they were related to trainee reports of overall job satisfaction.

A pattern of progress in personal development emerges from data showing that many graduates have been moving to better housing, buying cars to solve transportation-to-work problems, managing money responsibly (as demonstrated by using checking accounts and buying various kinds of insurance), and taking advantage of additional training opportunities. Nearly half belonged to non-work-related organizations such as clubs and churches at the time of the survey

Additional findings from the survey are described in Appendix A.

Training Special Groups

An especially interesting feature of TAT has been its developing ability to attract and accommodate widely varied groups of trainees. In successive experiments over the years since 1969, the following special groups have

been enrolled: Black youth from the inner city of Chicago; residents of rural Appalachia; minimum-security inmates of a nearby correctional institution; and high school seniors in Oak Ridge for whom the regular school program is less than satisfactory.

Youth From an Inner City. Early in 1969, 24 young, untrained black residents of Chicago's South Side were hired by the National Accelerator Laboratory (NAL), an AEC contractor, and sent to TAT for training to fill technical jobs. The Laboratory, home of a 200-billion electron-volt proton accelerator for high-energy physics research, was then under construction near Batavia, Ill., 30 miles from Chicago. Thus began a pilot project to find out if such relocation of ghetto residents provided a feasible approach to job training, to meeting industry's needs for trained workers outside urban areas, and to alleviating unemployment in core-city areas.

The pilot project showed that, with the proper combination of planning and followthrough, the approach is indeed feasible. Since then, two more groups of trainees have been selected from the same area and sent to TAT, under the same sponsorship and with similar good results.

The typical NAL trainee is a 20-year-old, black, single male (about 10 percent are young women) with no vocational training and a history of low-paid, casual employment. A number have had police records, and some have been convicted of misdemeanors and felonies. They had little experience of life outside the ghetto before coming to Oak Ridge. The initial group was housed in privately-operated dormitories, but later groups have tended to leave the dormitories as soon as arrangements to share houses and apartments could be made. While in training they participate in community life, dating local residents, receiving dinner invitations, and engaging in sports and other recreational activities. Visits from staff of the Laboratory keep them in touch with home. Counseling related to personal finances (among other things) in preparation for the move to Batavia, is furnished by both the Laboratory and TAT staff.

These trainees are, of course, subject to the regular attendance and disciplinary policies governing the rest of the enrollees. Progress has not been completely smooth. For example, one trainee was arrested and spent 4 months in the local jail; but he was far enough along in training to eventually complete it and go to work at the Laboratory. Initial reaction on the part of the trainees to attention in the local newspapers and to dinner invitations from whites was negative; but by the end of the training, most said they liked the climate, the slower pace, and the people.

Only two of the initial 24 trainees failed to complete the program. The remainder went to work for the Laboratory at starting salaries of $3 per hour, and most of them moved to homes near their work. At TAT they had developed skills in industrial electronics, drafting, or machining and basic mechanics and had made progress in academic areas related to these trades. According to a survey, this paid off in raises averaging 6 percent within a few months after the graduates reported for work. It also resulted in a high degree of satisfaction on the part of both the new workers and their supervisors.

The project changed attitudes of both blacks and whites. The black youth developed a willingness to leave home, as well as confidence in their future careers. White professionals were shown that there are disadvantaged blacks who can fill technical jobs. The company was committed to "the achievement of its scientific goals within a framework of equal opportunity and of a deep dedication to the fundamental tenets of human rights and dignity";[3] but it lacked a training capacity of its own. TAT was able to furnish that capacity. The company's attention to all the steps in the process—recruitment, job identification, the progress of its enrollees in the training program, relocation assistance, and followup on the job—has doubtless been important to the continuing success of the undertaking.

Prison Inmates. In April 1972, TAT enrolled a pilot group of nine "honor" inmates in its program. Two were dropped almost immediately for possession of drugs; but seven completed the course, setting good records in proficiency, human relations, and behavior. The inmates selected were first offenders serving 1- to 3-year terms in various Tennessee institutions.[4] Of those who persisted in the training, five were white and two were black. Only three were high school graduates.

Upon graduation from TAT, the seven trainees were assigned to the Work-Release Center, limiting their job placement to the immediate area. Because of a local scarcity of full-time jobs in the welding and machining skills in which they were trained, the graduates obtained work as laborers at an average beginning wage of $2.11 an hour. TAT staff members keep in touch with them and anticipate placing them in jobs related to their training when they are released and can move out of the area.

Residents of Rural Appalachia. Shortly after the experiment with black inner-city youth was undertaken,

[3] Statement of the Director, The National Accelerator Laboratory. *Special Report, TAT Satellite Training Project with the National Accelerator Laboratory.* Training and Technology Project, Oak Ridge, Tenn., January 1970.

[4] Although this was the first enrollment of persons currently serving prison sentences, TAT had previously trained more than 60 persons with criminal records.

the Appalachian Regional Commission (ARC) and the Department of Labor, in cooperation with the Department of Health, Education, and Welfare, funded a 2-year demonstration to find out whether the TAT program could prepare disadvantaged rural residents of Appalachia, most of them white, for technical jobs in industry. Several Federal and State agencies coordinated their interests and activities with those of TAT. Tennessee, Kentucky, Virginia, and West Virginia were the States involved.

Nearly 200 trainees were enrolled under ARC sponsorship in the four training cycles between October 1969 and September 1971. While some difficulty was experienced in recruiting enough suitable trainees, and the dropout rate was higher than the usual TAT experience, nearly two-thirds of those enrolled completed the program and 9 out of 10 of the graduates were placed in jobs. A few others entered the Armed Forces or went back to school. It was thus demonstrated that the package of manpower services developed by TAT can work for disadvantaged rural whites as well as for inner-city blacks.

Another positive outcome of this effort was that a number of regional manpower planning and development activities turned to TAT for technical aid. For example, TAT began to participate in both the East Tennessee and Knoxville-Knox County CAMPS committees, supporting efforts to achieve more coordination between the two area committees on the basis of overall manpower needs in the 16-county eastern Tennessee area. With the Tennessee State CAMPS committee and the Tennessee Valley Authority, TAT cosponsored a workshop on Planning Manpower Strategies. TAT facilities were made available to the University of Tennessee and Roane State Community College for classes in drafting, welding, machining, and related subjects, all offering college credits toward degrees.

High School Students. Also in 1972, a long-discussed idea for career education for Oak Ridge high school seniors materialized. Available TAT openings sponsored by the AEC were pressed into service, and 24 students were selected to fill them.

Selection criteria included (1) a requirement that participants reach age 18 by the time training is completed; (2) a minimum (sixth-grade) functional level in math and reading; and (3) parental consent. Emphasis was on choosing disadvantaged youth and those experiencing difficulty in adjusting to the regular high school program. After four participants dropped out early in the program, 15 boys and five girls remained. All of the girls and three of the boys were black. They were enrolled in drafting (four girls), machining (four boys and one girl), welding (nine boys), and mechanical operations (two boys). Their attendance record at TAT was below industrial standards but much improved over their high school record. (Two were eventually terminated for unexcused absences.) The financial strain of paying for lunches, transportation, and incidentals proved to be an acute problem, but it was eased when contributions from the community furnished an allowance of $10 per week per trainee. Arrangements were made for high school credits for participation in TAT; and, with the cooperation of high school teachers and TAT staff, all but one received their diplomas.

The young people generally expressed appreciation for the program and indicated that they found it much more relevant to their real needs than regular school. Confounding the misgivings of some adults, they continued to attend classes all through the summer vacation period. Seventeen of the 20 completed the TAT program—a good record for a group considered dropout-prone by the school staff. Of these, 12 were placed in jobs at an average wage of $3.61 per hour, two entered business schools, and three did not seek employment for health or other reasons.

The results so impressed the Oak Ridge School Board that they included funds in the following year's budget to finance 15 slots for an additional group of students, including some who were not yet seniors but met the minimum age requirement. According to the school principal, TAT has invested vocational training with a new dignity. The community used to be largely oriented toward academic achievement; but skilled work has come to be more highly regarded, and parents who once resisted the placement of their nonacademically-minded children in vocational programs vie for places for them in TAT. The school principal also regards the enrollment of students in TAT as a marshalling of community resources to deal with the dropout problem and to curtail the need for remedial programs.

Interest in TAT among other school districts is rising: several nearby high schools entered the program in the spring of 1973 on the same basis as the Oak Ridge school. Cooperative arrangements for Oak Ridge teachers to furnish academic instruction to enable the trainees to meet high school graduation requirements are possible.

Benefits for Regions, States, and Localities

These accounts of the adaptation of TAT to the needs and circumstances of special groups point up an important aspect of the program; that is, how—given the

cooperation of a number of public agencies—it can fill some of the manpower development needs of regions, States, and localities. The Oak Ridge community is well served by the continuing enrollment of dropout-prone high school students. The graduation of the offender group demonstrated TAT's ability to contribute to the solution of a critical social and manpower problem, the rehabilitation of inmates of State correctional institutions.

The recruitment and training of rural Appalachian residents required coordination with a regional agency as well as with agencies of four States. The arrangements for training inner-city youth for a particular employer cross regional and State lines, while the "buy-ins" by other manpower programs traverse State and local area jurisdictions.

This demonstrated flexibility suggests that the TAT model would fit well in the manpower revenue sharing pattern, since its accessibility to many political jurisdictions represents efficient utilization of both training and manpower resources. Training opportunities are being extended to enrollees who would have missed them without the duplication of expensive equipment, facilities, and technical expertise.

Benefits for Employers

The Nuclear Division, Union Carbide, has carried the basic training responsibility for the entire program, but it has never been committed to hiring all the graduates. The company sees much benefit in exposing its employees to the training experience as instructors, especially in having them see first-hand that the disadvantaged have a potential for learning and, when properly brought along, for competence as workers. When these employees return to their regular jobs, they are better workers and supervisors.

Another plus for the company has been a trained, local supply of workers at the times when they were needed. With its own employees as instructors, it can be supposed that the plant has been able to tap the most promising graduates as workers. Moreover, a high proportion of black trainees has permitted a buildup in the employment of minorities in accordance with Federal requirements for equal employment opportunity.

Company staff probably also respond to the challenge of using available material and human resources to help curtail the waste inherent in untrained and, therefore, underutilized manpower. And the terms of the contract with the AEC make it possible for the plant to engage in the training without financial penalty.

The number of employers hiring TAT graduates has grown appreciably over time, attesting the program's ability to turn inexperienced recruits—most of them having characteristics associated with disadvantaged backgrounds—into reliable, trained workers.

II. MANAGEMENT, ADMINISTRATION, AND COSTS

The TAT training program began as an experimental and demonstration project to test the practicability of using industry resources for other than conventional on-the-job training and for preparing workers for relatively high-wage entry jobs in technical operations. It grew out of a 1965 study of Southern manpower resources conducted for the Department of Labor by Oak Ridge Associated Universities.[1] The study recognized the paradox of wide-scale unemployment and underemployment in the face of unfilled demands for skilled workers and pointed to the existence of idle capacity in industry that might be applied as a training vehicle to the solution of the problem. The study envisioned cooperative planning and coordination with public manpower agencies.

The demonstration funding of TAT training ended in 1968; since then, it has been supported (primarily) from MDTA funds administered at national office discretion and from AEC funds. The Tennessee Department of Employment Security certifies enrollees, while the State vocational education agency approves the training.

Roles of ORAU and the Training Company

ORAU, the prime contractor for the training (and related research), is a university-sponsored management corporation of long experience, with its qualified, permanent staff working closely with Union Carbide's Nuclear Division in a number of projects.[2] In the case of TAT, their roles are somewhat overlapping and mutually supportive. Generally, ORAU carries the responsibility for TAT's overall administration and community relations and serves the trainees' interests and needs, while the company insures the integrity of the training and its conformance with industry's standards and requirements. (See chart 1.)

Because ORAU is free of direct responsibility for training, it functions well as an independent program advocate with supporting groups. At the same time, industrial management and training personnel are relieved of the chores of program management, contracting, financing, and reporting by their partners in the program.

TAT has found that building a team of organizations with vested interests in the projects—from local unions to a national labor organization, or from local civic clubs to Federal agencies—is a good approach to organization and management. Although requiring a substantial commitment of staff time to meetings, conferences, and reporting, the network of contacts and resources thus mobilized contributes significantly to the positive results which have been obtained.

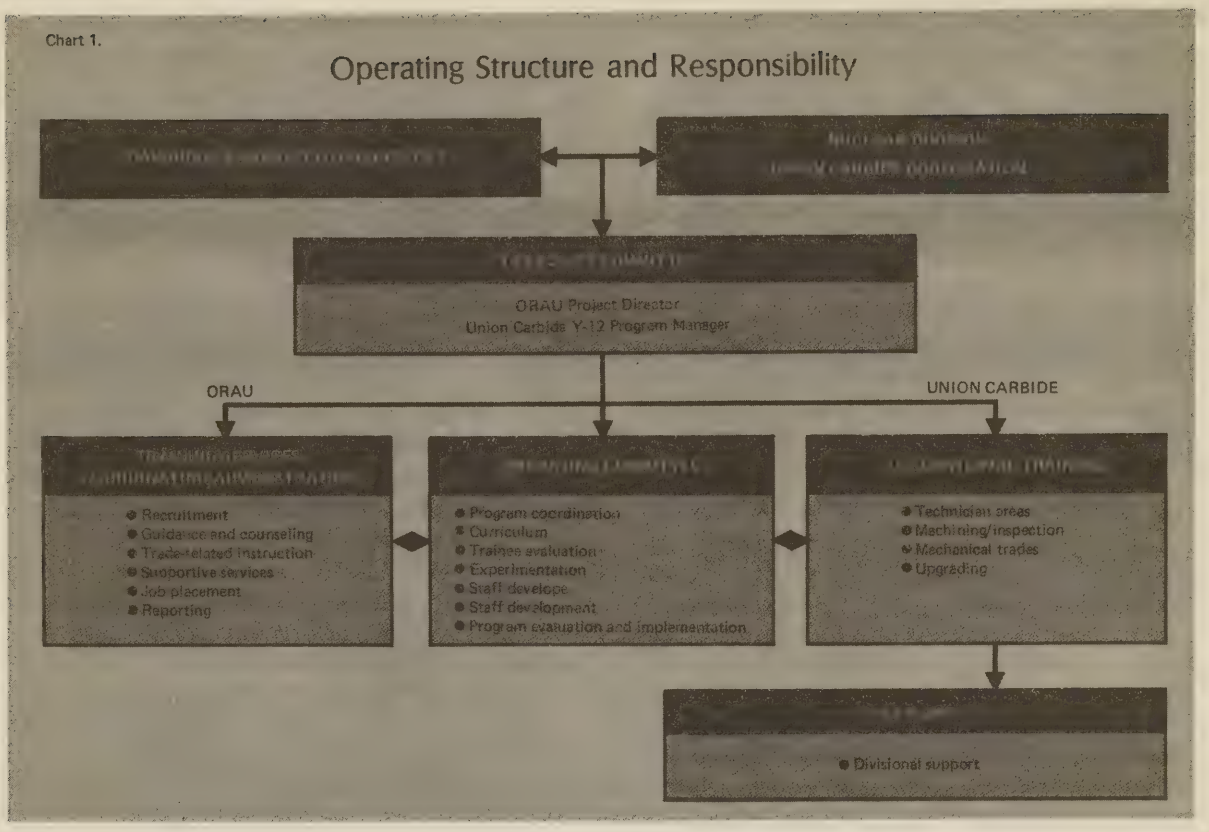
Contractual and Funding Arrangements

TAT training cycles have been covered by a series of contracts or agreements with a sponsoring agency or combination of agencies and organizations. Most have taken the form of interagency agreements among the Departments of Labor and Health, Education, and Welfare, and the AEC, to make the services of ORAU and the Union Carbide Company available through existing AEC prime contracts. The extension of regular AEC

[1] *Resources for Southern Manpower Development*, Oak Ridge Associated Universities (ORAU), Oak Ridge, Tenn., 1965.

[2] Some of ORAU's long-standing activities are administering AEC fellowship programs for graduate study; holding short courses and institutes for scientists, physicians, educators, and technical personnel in the safe and efficient use of radioisotopes; and conducting clinical research in nuclear medicine. TAT is administered from an ORAU office building located near the Union Carbide Complex in Oak Ridge.

Chart 1.



contracts to cover TAT operations has had advantages in assuring consistent administrative and fiscal policies and in avoiding duplication of efforts.

Diversification in funding arrangements has occurred as industry and other public agencies have become participants. Moreover, a departure from usual practice has been the considerable variety in the ways the two principal cost components–subsistence allowances and training costs–have been supported. A basic pattern of 50/50 division between national MDTA funding and that of another sponsor has provided great flexibility, with MDTA funds sometimes used to cover training, sometimes for allowances–depending on the availability of other funding.

The following summary of sponsors and enrollees through courses ending in March 1973 reflects the viability of the assortment of cost-sharing arrangements that have been employed. (Sponsors may provide partial or full funding.)

Sponsor	*Number of enrollees*
Total	2,529
AEC contractors:	
at Oak Ridge	450
in other locations	164
Appalachian Regional Council	184
Concentrated Employment Programs[1]	295
WIN Projects[1]	40
West Virginia MDTA[1]	5
Oak Ridge School Board[2]	39
Tennessee Dept. of Corrections[3]	9
Standard Oil of Indiana	12
Not sponsored[4]	1,331

[1] In these "buy-ins" by other manpower programs, sponsors pay both training costs and subsistence allowances. Programs are located in Chattanooga, elsewhere in Tennessee, and in West Virginia.

[2] Training slots sponsored by the AEC were used initially and no subsistence allowances were provided. Currently, the School Board pays for training costs.

[3] Training slots sponsored by the AEC were used, but the Department of Corrections paid subsistence costs.

[4] Both training and subsistence costs paid out of national MDTA funds. Included here are 227 veterans in recent classes and 624 trainees in the original E&D project.

TAT Costs

For the training year ending in September 1972, the average cost of training and subsistence allowances per enrollee over a 6-month training cycle was as follows:

Training costs[1]	$1,399
Supportive services	437
Subsistence and transportation allowances	1,368
Total	$3,204

[1] Exclusive of capital costs involved in the training facility and equipment supplied by the AEC.

Subsistence and transportation allowances vary substantially with the number of dependents an enrollee is supporting, his place of residence, and the sponsorship of his training. Furthermore, since the program is accredited by the Veterans Administration, eligible enrollees may elect to receive benefits of $220 monthly[3] under the Vietnam Era Veterans Assistance Act of 1972, in addition to the MDTA allowance. On the other hand, there is no provision for allowances to enrollees who come into the program under the auspices of the Oak Ridge High School or the public adult education program.

[3] The allotment for veterans with no dependents.

Since not all enrollees complete training, and since not all who do graduate go on to employment, it is important to know the cost per completer and the cost per placement in addition to the cost per trainee. These amounted to $3,890 and $4,471, respectively, in the 1971-72 training year.

In contrast, data for MDTA institutional training (the national manpower program most nearly comparable to TAT) show a per-participant cost of $2,635 for fiscal 1972, based on a per-man-year cost of $7,120 and an average length of stay in the program of 19 weeks. Costs of allowances in MDTA were somewhat higher than in TAT, averaging $1,423 in fiscal 1972. TAT spent significantly more on supportive services than did MDTA, and also invested more in each enrollee's training. Since a little less than three-quarters of those who left the MDTA program that year completed training, the cost per completer was nearly $3,700. The further attrition between completion and placement raises the per-placement cost to more than $4,900.[4]

[4] These are Federal costs only. The legislation requires a 10-percent matching State contribution, in cost or in kind.

III. PROGRAM COMPONENTS

The Industrial Setting

TAT's industrial setting is a prime ingredient of training success. Trainees in TAT enter the Union Carbide plant through the same gates and at the same time as plant workers. They must display the same identification badges. Although they report to a separate building which has been remodeled to accommodate the training and related educational activities, they are in a shop which looks like a regular shop, using up-to-date industrial machines and equipment, and observing still other machines and equipment in use. They are subject to the same plant rules and discipline as the workers.

Their instructor-foremen are Union Carbide journeymen who grade shop tasks mostly on an accept-reject basis in accordance with strict industrial specifications. The in-plant environment is generally regarded as having a significant impact in bolstering the holding power of the program, in motivating the trainees, and in aiding the formation of work habits that will prepare graduates for the real obligations of employment.

Recruitment and Selection

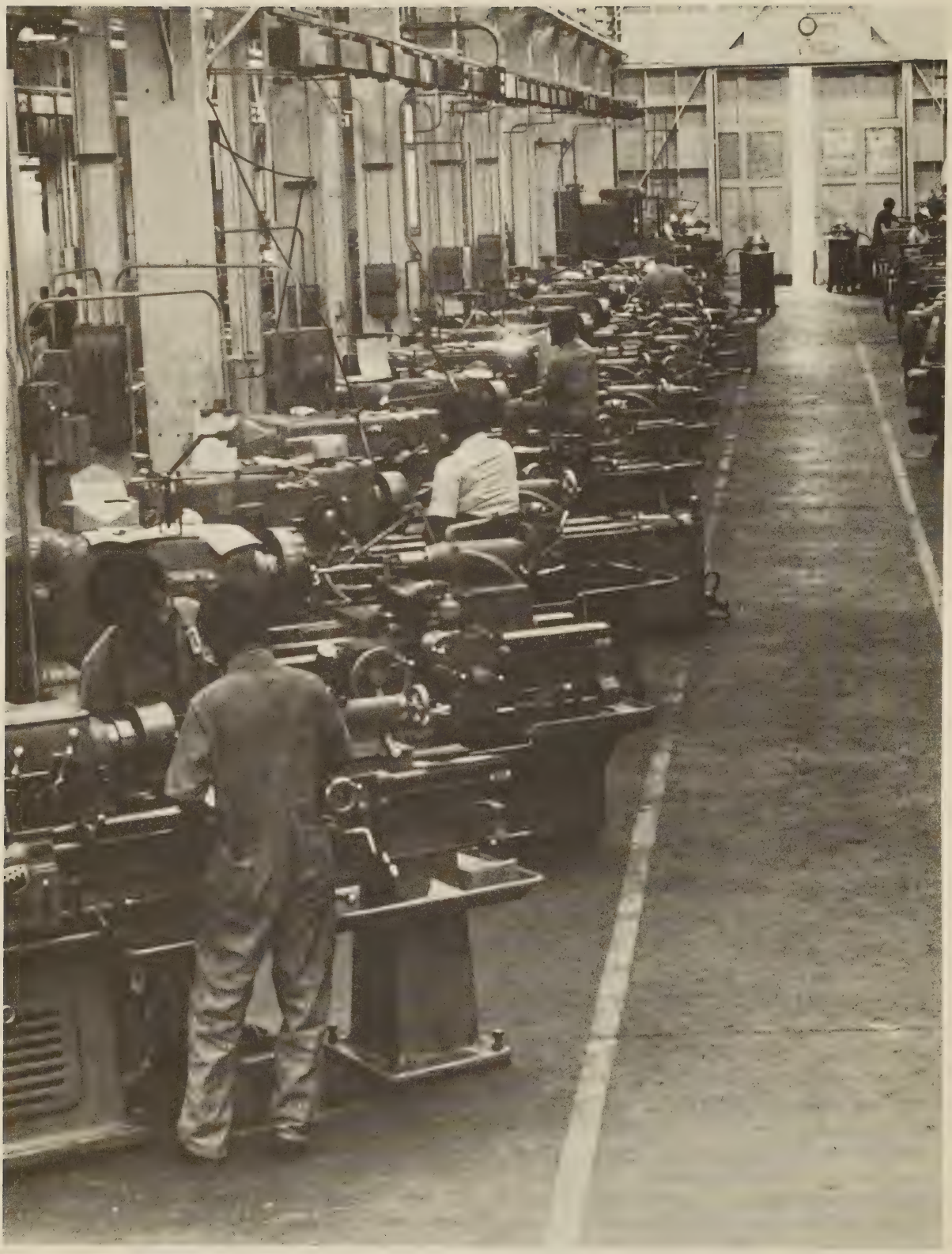
TAT attracts 10 applicants for every opening. An important reason for this striking ratio is simply that word is out that the program delivers good jobs for its enrollees. The participation of training instructors in the selection process is probably also a critical factor in program success which, in turn, facilitates recruitment. However, recruitment has been accorded a high priority since the outset of the program. TAT not only has recruited through the media and the employment service but also has worked cooperatively with unions, employers, and, recently, the public schools.

Most of the trainees have come from surrounding rural and urban areas, but recruitment efforts have extended as far as Chicago's inner city and the Appalachian Mountains in Kentucky, Virginia, and West Virginia, with TAT staff traveling to these outlying areas to assist in the selection. Local CEP and WIN programs have bought training slots, and TAT staff members have screened those programs' enrollees to select trainees. During the TAT year ending in September 1972, the priority given to enrolling veterans in MDTA training resulted in a high proportion of veteran participants.

Recruiting the Disadvantaged and Minorities. Initially, admission to this intensive skill training was limited to high school graduates with 2 years' work experience or some vocational training beyond high school; intensive publicity and the cooperation of local public employment offices turned up enough suitable applicants to fill the openings in these early days. Only 15 percent of the enrollees were blacks or members of other minority groups, and only a handful were technically "disadvantaged." However, experimentation with a group of trainees who did not meet the original high admission standards showed that they could master the courses despite their limited educational background. Thereafter, the program increasingly enrolled undereducated, poor, more severely disadvantaged trainees. Since the third year of the program, nearly 4 out of 5 of the trainees have been disadvantaged,[1] and minority group representation (mostly blacks) has amounted to 40 percent.

Staff members have learned to adapt their recruitment techniques to blacks, who are less likely to read publicity, visit local employment offices, or take the

[1] The employment service determines whether a given individual meets the criteria for disadvantagement.



initiative in applying for training.[2] One full-time black recruiter makes tapes for the local soul music radio station and visits the nearest Community Action Agency and Neighborhood Youth Corps (NYC) programs. Local black ministers have also been effective spokesmen for TAT. Although the staff works harder to recruit blacks, the same standards of selection are applied across the board.

Efforts to enroll more women have been less successful. However, a few women have been in each training cycle, amounting to about 5 percent overall.

Tour-Test and Interview. Based on a review of completed forms, applicants judged suitable for the program (perhaps a third of the total) are invited to a "tour-test and interview," followed by final selection of those most likely to profit from technical training. Tests are administered to determine level of academic competence and to indicate areas of occupational interest and capability.[3] Applicants are asked to name a first, second, and third choice of training areas.

But the greatest weight in selection is given to the assessments of interests and capabilities made by instructors in structured interviews which follow orientation tours of the training areas. Using records of the interviews and tests, a team—comprised of an employment service representative, the training supervisor, a trainee services staff member (counselor), and a representative of the sponsor agency (if any) for the particular opening being filled—makes final selections.

TAT follows a practice of selecting a pool of alternate enrollees for each training cycle so that, if anyone fails to report for training or drops out early in the course, he can be promptly replaced. Considerable emphasis is placed on willingness to relocate after training, because not all trainees can be placed locally.

Trainee Characteristics. These policies and procedures have led to the selection of a group of trainees with the following characteristics:

Characteristics of TAT Enrollees (September 1966-September 1972)

Characteristic	*Number*	*Percent*
All trainees	2,258	100
Men	2,150	95
Women	108	5
White	1,447	64
Black	790	35
Other[1]	21	1
Residents of Tennessee	1,966	87
Residents of 14 other States	292	13
Employed at time of enrollment	863	38
Not employed at time of enrollment	1,395	62
Disadvantaged[2]	1,259	75
Not disadvantaged[2]	412	25
High school graduates[2]	1,251	75
Less than high school graduates[2]	420	25
Single[3]	--	33
Married[3]	--	61
Divorced, separated, widowed[3]	--	6
Average age at entry[4]	22	
Average educational achievement[5]		
Arithmetic	Grade 7.9	
Reading	Grade 7.3	

[1] Includes Spanish-speaking, American Indian, and Eskimo enrollees.
[2] Relates only to those enrolled since 1968.
[3] Based on sample followup survey rather than enrollments.
[4] Range is from 17 to 53 years of age.
[5] For 711 persons enrolled since 1970.

The typical TAT trainee is thus a young, white, male Tennesseean. (Two-thirds have been 22 years of age and younger, only 3 percent over 35 years of age.) He is quite likely to be a high school graduate but unlikely to perform at that level on standard achievement tests. His previous employment record is unimpressive; more than likely he was unemployed when he started training.

Training and Trade-Related Education

The TAT program includes 40 hours of intensive training and trade-related education each week for 26 weeks, totalling approximately 1,000 hours. On the average, 5 hours per week are devoted to math, 3 to

[2] The proportion of blacks in the Knoxville standard metropolitan statistical area (SMSA), where TAT is located, is about 7 percent.

[3] The tests used are the Adult Basic Learning Exam, Level A, for academic achievement and the General Aptitude Test Battery (GATB) for guidance in determining appropriate areas of occupational training. Applicants who fail to meet the requirement for at least sixth-grade academic performance are encouraged to enroll in adult basic courses and to try again. Others not selected are advised to seek placement assistance with the public employment service or, if they are handicapped, with the vocational rehabilitation agency. The latter, in turn, sometimes refers clients to TAT; thus, a few physically handicapped persons have completed the program and been placed in jobs.

science, and 2 to blueprint reading. Personal counseling and employment seminars claim a few hours. Most of the time, however, is spent in shop and laboratory instruction involving "hands-on" use of advanced production equipment. The training facility is in use from 7 a.m. until 11 p.m. to accommodate two shifts in machining and welding.

TAT training has advantages over conventional vocational training because it operates in an industrial environment rich in technical resources. This affords more hours per week of instruction, a relatively low 12-to-1 ratio of students to instructors, and opportunities to work under several different teachers in the course of training. Work tasks are arranged in a sequence, from the simple to the complex, to bring the trainee up to exacting industrial standards.

Understandably, trainees vary both in ambition to learn and in the speed with which they acquire competence. Instructors use a flexible approach to these individual differences, recognizing that some graduates will have reached a higher level of skill than others. But all of them will have been prepared by a thorough and versatile training experience for further, on-the-job progress.

With a professional remedial teacher on the staff, remedial education is available as needed. Programed study materials are used, and preparation for a GED (high school equivalency) diploma is offered on a voluntary basis. In a recent class, all 38 enrollees who lacked a high school diploma took advantage of the offering; and 90 percent passed the test on the first attempt.

Occupational Training Areas. Training is given in six occupational areas keyed to industrial demand:[4]

(1) Machining;

(2) Combination welding;

(3) Mechanical operations (various production operations in sheet metal, pipe fitting, hydraulic mechanics, etc.);

(4) Physical testing (radiography, metallography, and various other nondestructive testing methods);

(5) Electronics;

(6) Industrial electricity.

Occupational offerings have varied somewhat, depending on indications of changing employer demand. The staff continuously collects information on job demands, primarily from employers with whom former graduates have been placed. Among the areas dropped

[4] See Appendix B for course outlines.

have been glassblowing and mechanical drafting. On one occasion, in response to specific demands, chemical technicians were trained. In mid-1973—as the local Union Carbide gaseous diffusion plant was being remodeled to expand production—consideration was being given to adding a new training area shaped to the resulting manpower demands, as well as to adapting the ongoing training in physical testing to the new requirements of the plant.

Instruction by Industrial Personnel. As already noted, instruction is conducted by Union Carbide engineers, technicians, and craftsmen who volunteer for the training assignments, while trade-related theory is taught by ORAU engineers and technicians. Curricula are worked out by the instructors and are kept flexible. Instructors accompany job developers on periodic visits to industrial plants to see what changes in processes are taking place that have implications for the training. Sometimes employers make tentative commitments to hire particular trainees a number of weeks in advance of the end of a training cycle; during the remaining weeks, the instructor emphasizes the processes or skills specified by the future employer.

Monitoring Trainee Progress. In addition to grading some shop tasks on an accept-reject basis, instructors give regular grades denoting general progress. Counselors are apprised of these grades, along with weekly test scores on theory and trade-related academic subjects, and daily attendance and tardiness records. A comprehensive evaluation of each trainee is prepared at 45-day intervals, although difficulties at any time are noted and remedial action taken in the form of extra tutoring or disciplinary measures.

Trainees proceed at their own rate until they are certified as job-ready by their training supervisors. In the first year of TAT, courses were scheduled for 12 months. Later they were telescoped to 9, then to 6 months. A recent study suggests that a further shortening of course length is feasible, since enrollees are spending an average of 21¼ weeks in training before being placed in jobs.

Counseling and Supportive Services

The supportive services provided by TAT are wide-ranging and individualized. They include help with locating suitable housing, transportation to the training site, after-hours recreation, and assistance with personal, medical, and financial problems. Two full-time counselors and a part-time recreation director, with some support from the community, serve the 200 enrollees in these areas.

Counselors meet applicants at the tour-test interviews, administer tests, conduct the employment seminars, and deal with personal problems as they arise. Monitoring trainees' progress and spotting problems at an early stage is the responsibility of the counselors.

Normal discipline is the province of instructors, who apply industrial rules on safety, attendance, and other behavior to the trainees on the same basis as they are applied to regular Union Carbide workers. Allowances are docked for unexcused absences, and infractions of rules may put a trainee on probation. Either an instructor or a counselor may initiate a round-table conference to find solutions to a particular trainee's problems.

Decisions to terminate a trainee may be reached only by agreement between the instructor and counselor. Such decisions are rare, and the staff credits the general success in surmounting problems to the teamwork among counselors, other staff members, outside consultants, and the community.

Keys to effective counseling appear to be systematic coordination with all the staff, a sensitivity to problems signaling the onset of a crisis so that it may be warded off, and prompt attention to the crises that do develop.

Community Support

In earlier years, large numbers of out-of-area trainees came to Oak Ridge for the duration of training and were housed mostly in privately-run dormitories. More recently, the proportions have shifted to about 70 percent daily commuters and only 30 percent from out-of-area. Trainees prefer, and generally find, housing alternatives to the dormitories.

Community support of the program has grown over the years. A TAT community advisory committee of 25 members meets quarterly to review new programs, consider the addition of new participants (notably the high school group), and generally represent the community's interest in the project.

In 1969, when friction developed between local residents and nonlocal enrollees, the TAT Community Council was formed, with a membership representing the police, city council, newspapers and radio stations, organized labor, and citizens. For a time, the council met once a month to deal factually and unemotionally with several incidents. Since then, tensions have subsided and the council has met only occasionally.

Job Development and Placement

Job development and placement are very much in the minds of the staff concerned with recruitment and selection, and of all those responsible for seeing the trainees through to graduation. The placement objective prompts the four hour-long seminars which are convened midway in the training cycle to give the trainees practical help in obtaining jobs. Here they practice filling out applications, simulate job interviews, and take actual pre-employment tests pegged to the several training areas.

The placement officer not only works through the public employment service but also solicits job orders directly from companies. Leads are supplied by advertisements in nonlocal newspapers and by companies which have hired TAT trainees in the past. In fact, a kind of placement network has developed over the years, as one satisfied employer has told another about this source of new workers trained in technical skills.

On occasion, questionnaires have been sent to companies known to be engaged in industrial operations requiring the skills taught. They have elicited information about the machines used, the processes involved, and the worker capabilities required. While the rate of response has not been high, telephone followups on those questionnaires that do come in have often resulted in job orders. Former trainees also furnish tips on job openings suited to TAT graduates.

The process of tailoring the training to employer needs is multifaceted. For trainees who attend TAT after being hired by a sponsoring company, cooperation and coordination with the sponsor in all phases of the program can be construed as a kind of placement service. As already noted, instructors are actively interested in keeping the training up-to-date. In addition to their making trips to plants, recruiters from firms that hire TAT trainees are invited to visit the training site. Many do make such visits, using the occasion to give instructors advice on special training emphases that will groom trainees for jobs in their companies, e.g., in blueprint reading or patternmaking.

Through these highly individualized methods and practices, practically all graduates have been placed in technical entry-level jobs, for the most part related to the training. Some TAT graduates are given as much as a year's credit in formal apprenticeship programs.

IV. POTENTIAL FOR EXTENSION OF THE TAT MODEL

It has been suggested that TAT's accomplishments mark it as a possible model for other manpower development efforts. In fact, steps in this direction have already been taken, abetted by developmental technical assistance provided through R&D funding from the Department of Labor (DOL).

Movement Toward Replication

A small offshoot of TAT has been operating for some time at Paducah, Ky., where Union Carbide also operates a plant under contract with the AEC. In addition, the Sandia Corporation in Albuquerque, N. Mex., another AEC contractor, is considering establishment of a program modeled after TAT to serve western AEC contractors. A planning group in West Virginia has asked the TAT staff for assistance in developing a mine technology training center to meet manpower needs in the increasingly mechanized deep-mining coal industry.

Finally, Standard Oil of Indiana, having enrolled a few of its workers in TAT, has taken the lead in developing a Chicago area training consortium with assistance from TAT staff. Training in chemical technology and related fields is being offered at the company's Research Center at Naperville, Ill. A local junior college has assumed overall administrative responsibility, while MDTA support for training costs has been assured by action of the Illinois Employment Service and the State Division of Vocational Education.

Surrogates for TAT Partners Needed

These first movements toward replication have underlined the need to (a) gear the program to occupations for which there is a clear demand and which require significant skill training, and (b) identify agencies and institutions in different localities which are capable of assuming the roles and responsibilities of the original TAT partners. Whatever varying "mixes" are eventually featured in TAT-derived programs, five components seem to be essential:

(1) Industrial resources (furnished in TAT by Union Carbide);

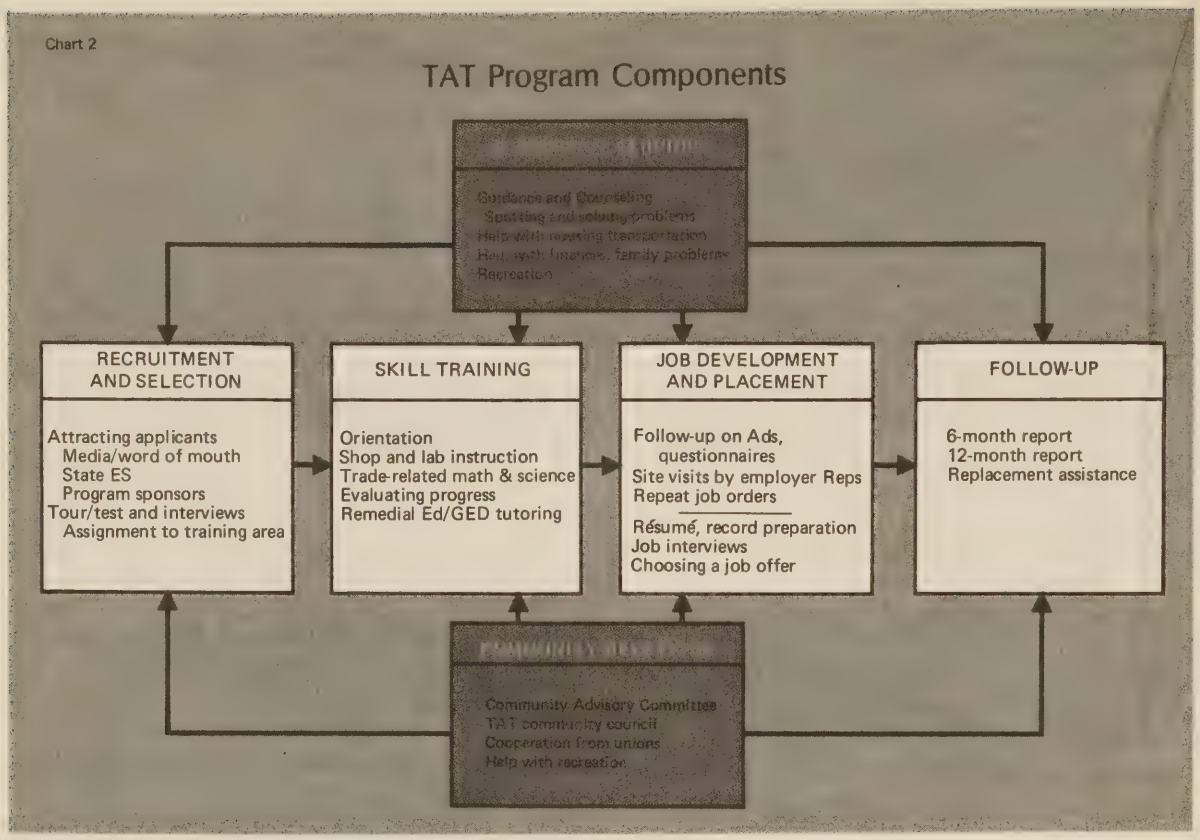
(2) Educational resources (ORAU and the Oak Ridge High School for special needs of one group of trainees);

(3) Supportive services (ORAU with community assistance);

(4) Program development and management (ORAU; DOL has had some part in program development); and

(5) Financial support (primarily Department of Labor, Department of Health, Education, and Welfare, and Atomic Energy Commission, with smaller inputs from local and State agencies and companies).

In addition, the careful and coordinated attention given to all aspects of the project, from recruitment and selection through community relations–TAT's "systems" approach illustrated in chart 2–would be an important ingredient of similar programs.



Many companies have idle but up-to-date production equipment which could be used for training, a facility that, with minimal remodeling, could be used, and the capacity to provide shop and laboratory instruction by experienced craftsmen and engineers. The functions performed by ORAU in TAT could be assumed by a community college or a technical training institution—although their resources might require considerable augmentation by other community agencies and groups, depending on local circumstances.

TAT experience demonstrates that multiple and flexible funding sources and arrangements are possible. Because of Federal budget stringencies and the impending shift to manpower revenue sharing, national support for TAT training from MDTA resources ended with the April-September 1973 cycle. However, manpower program funds allocated to States and localities can be used by them to finance enrollments of trainees in such a program. Proponents of this kind of training will need to work through State and area Manpower Planning Councils (MPC's) to have their proposals incorporated in manpower plans. Other resources capable of supporting manpower activities might also be reached through the MPC's, since eight Federal agencies in addition to the Department of Labor are joined in the parent Cooperative Area Manpower Planning System (CAMPS), and since State and local agencies are also represented on the councils.

Possibilities for funding through State and local agencies have been illustrated by the involvement in TAT of the Tennessee vocational rehabilitation agency, the State correctional agency, and local school boards. As previously pointed out, TAT has also had limited support from private companies, and funding arrangements have crossed State and regional lines.

There are 60 major industrial firms (employing over 100,000 workers) under contract with the AEC, 180 firms (with an estimated 200,000 or more workers) under contract with the Department of Defense, and several firms working on National Aeronautics and Space Administration contracts. Obviously, there is a large potential in this significant segment of the economy for replication of the TAT approach to manpower utilization. Perhaps the greatest impetus to the spread of this kind of institutional training with its on-the-job aspects would be congressional expression of a national policy declaring it the obligation of companies operating government-owned facilities (popularly known as "GO-CO's") to provide training to meet requirements originating outside the training companies as well as their own manpower needs.

Problems in Replication

The results of the staff's ongoing efforts to apply and extend the lessons learned have demonstrated that replication of TAT is possible. However, difficulties in extending the TAT model should not be minimized, nor should its potential for solving manpower problems be overestimated.

The approach has worked well for a particular group among the disadvantaged, but its application to those with severe educational deficiencies and serious motivational problems would undoubtedly require far greater investments of time and money. It has worked well because job demands have been carefully identified; still, the range of skills covered has been limited, largely to industrial production-type operations. Inclusion of rapidly growing service and white-collar occupations is possible and would be desirable in a larger program.[1] Finally, it has worked well because of a capability for collecting feedback on the post-program experience of graduates, and for evaluating and adapting the ongoing program—a capability that has been weak or lacking in most manpower program operations.

In effect, the TAT staff has performed the planning function well. The transfer to a different arena could introduce elements of serious uncertainty in the identification of suitable trainees, in obtaining the kind of labor market information needed to identify accessible jobs for training graduates, and in carrying out useful evaluation and followup activities. A critically important factor would be coordination with other programs, especially with MDTA activities during the period of transition to manpower revenue sharing. MDTA is presently the major avenue to institutional skills training for the disadvantaged in most areas.

Such problems are not insurmountable. They are at the heart of the challenges facing manpower practitioners; but TAT's trail-blazing activities at least point toward solutions. TAT experience presents some answers, among the varied ones that are doubtless possible, to the questions raised at MDTA's 10th birthday party: Who should be doing what? Under whose guidance? With whose money? With what approaches and techniques?

Additional details about the TAT program are available in the reports listed in the following bibliography, or they may be obtained through visits to the TAT site.

[1] For example, consortia of hospitals in a metropolitan area and of downtown department stores might serve as training institutions in these occupational fields if they were relieved of the program development and management chores by other agencies.

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APPENDIXES

APPENDIX A

Summary Findings from a *Survey of Post-Placement Experience of TAT Graduates*

Manpower program outcomes are, of course, influenced by many variables in addition to the kinds and quality of services provided. Important among them are the characteristics of the enrollees, the occupational area in which training is given, and the general economic conditions prevailing at the time the enrollees seek jobs. Researchers used the followup data to relate the several measures of TAT post-training experience to some of these variables.

They found that blacks generally do as well as whites in post-program earnings, although they appear to be slightly less satisfied with their jobs and exposed to more job adjustment problems. Like the graduates themselves, employers more often reported problems for blacks and gave them somewhat lower average performance ratings. It is possible, of course, that discriminatory attitudes contributed to these results.

The disadvantaged, as a group, differ little from the nondisadvantaged in post-program experience. Starting wages and supervisory ratings slightly favor them, and their unemployment rate at the time of the survey was significantly lower. The small number of women in the sample started work at lower pay than the men and their unemployment rate was higher. However, they appeared to be both satisfactory and satisfied workers.

Level of formal education is positively (but not significantly) associated with higher pay and is not associated with job performance or job satisfaction.

Time of Graduation and Employment Experience. In an effort to assess the impact of economic conditions on program outcomes, trainees were divided according to graduation dates among three time periods marking corresponding phases of the TAT program: (1) 1966-68—The experimental and demonstration phase. Trainees were recruited locally (including relatively few who were disadvantaged), training lasted up to a year, and economic conditions were generally good. (2) 1969-70—Disadvantaged trainees were being added rapidly, while the geographic range of recruitment and job placement was expanding; but toward the end of the period, an economic downturn occurred. (3) 1970-72—Recruitment of the disadvantaged was emphasized, a significant number of trainees and jobs were out-of-area, and relatively loose labor markets and surpluses of experienced workers prevailed.

The data show that starting pay rose over time but peaked in the second period, despite a continuing overall uptrend in wage rates. The generally looser labor market of the last period, with more experienced workers seeking jobs, may have been a factor in this. Training-related jobs were obtained by smaller proportions of the graduates in successive time periods, while unemployment rates (at the time of the survey) moved up for successive groups—possibly reflecting the need for additional time on the part of some graduates to settle into jobs. Otherwise, there is little apparent relationship between measures of post-program experience and time of graduation. As table 1 shows, the placement rate for graduates has varied little over time.

Variations by Occupational Training Areas. Pay, job satisfaction, and other post-training success indicators varied substantially among occupational training areas, but no single area stands out as extremely advantageous or disadvantageous. Graduates in chemical technology achieved the highest starting pay, and their jobs were all training-related, since they were trained for a particular employer. But they had the highest incidence of job problems and a below-average rate of job satisfaction. Highest overall job satisfaction and a high proportion of training-related jobs characterized drafting graduates: only 2 percent of them were unemployed at the time of the survey. However, their pay rate was relatively low. Physical testing graduates reported fewer job problems than most groups and were relatively satisfied with their jobs. Nevertheless, their unemployment rate averaged 9 percent and their pay rate was lower than that of other groups. Graduates in welding and electronics scored high in post-training wages; but their unemployment rates were also high, and the welders experienced an about-average share of job adjustment problems. Graduates trained in mechanical operations and machining were near the average in most respects.

Outcome measures for the graduates in seven training areas are shown in table 2.

High-Success and Low-Success Groups. In another approach to examining the varying success of graduates, "high" and "low" success groups were identified on the basis of post-training wages and on the training-relatedness of the jobs obtained. The high group is comprised

TABLE 1. MEASURES OF POST-TRAINING EMPLOYMENT EXPERIENCE FOR GROUPS OF GRADUATES[1]

Item	Percent in sample	Average hourly starting pay	Average supervisory rating[2 3]	Overall job satisfaction[3]	Unemployment rate, time of survey
Race					
Black	34	$2.83	2.83	3.39	13
White	66	2.85	3.38	3.62	7
Disadvantagement					
Disadvantaged	75	2.86	3.15	3.49	9
Not disadvantaged	25	2.94	3.00	3.66	13
Sex					
Men	95	2.87	3.20	3.54	9
Women	5	2.44	3.38	3.72	16
Education					
Less than 12 grades	18	2.81	3.13	3.63	12
12 grades	71	2.86	3.11	3.50	9
More than 12 grades	11	3.04	3.06	3.59	13
Time of graduation					
1966-68	15	2.67	3.73	3.58	6
1969-70	48	2.97	3.22	3.68	9
1971-72	37	2.77	2.90	3.36	12

[1] Small but obvious differences in the averages for the several dichotomies—e.g., for the black/white and disadvantaged/nondisadvantaged—result from failure to obtain usable responses to all questions on all questionnaires.

[2] Obtained for only 40 percent of the sample.

[3] On a scale of one (low) through five (high).

TABLE 2. MEASURES OF POST-TRAINING EMPLOYMENT EXPERIENCE BY GRADUATES' OCCUPATIONAL TRAINING AREAS

Occupational area	Percent of sample	Average hourly starting pay	Average overall job satisfaction[1]	Percent with		Unemployment rate (percent)
				Training-related jobs	Job adjustment problems	
All areas	100	$2.85	3.54	63	45	9
Physical testing	14	2.71	3.64	60	40	9
Drafting	11	2.72	3.81	78	51	2
Mechanical operations	16	2.89	3.62	46	47	11
Machining	40	2.80	3.51	62	45	9
Welding	11	3.09	3.21	69	34	12
Electronics	6	3.05	3.68	71	42	16
Chemical technology	2	3.31	3.10	100	82	9

[1] On a scale of one (low) through five (high).

of 72 sample graduates with training-related jobs whose wage rates fall in the highest quartile, while the low group is comprised of 80 graduates with wage rates in the lowest quartile and non-training-related job duties. The demographic characteristics of the two groups and other measures of post-program experience were then compared, with the results shown in table 3.

The more successful graduates are slightly older, and all are men. They include somewhat lower proportions of blacks than whites, but slightly higher proportions of

TABLE 3. CHARACTERISTICS OF "HIGH" AND "LOW" SUCCESS GRADUATES AND MEASURES OF THEIR POST-TRAINING EXPERIENCE

Characteristic[1] or measure	High-success group	Low-success group
Average age at starting training	24.0	22.4
Percent who were:		
Black	21	32
Female	0	11
Married	81	48
Disadvantaged	77	74
Employed at starting training	87	31
Percentage distribution, by educational		
Less than 12 grades	14	23
12 grades	75	71
More than 12 grades	11	6
Percentage distribution, by training area		
Physical testing	6	20
Drafting	3	6
Mechanical operations	11	14
Machining	50	44
Welding	21	14
Electronics	6	1
Chemical technology	4	0
Percentage distribution, by time of graduation		
1966-68	8	13
1969-70	68	29
1970-72	24	59
Average hourly wage, last pre-training job	$2.08	$1.78
Post-program measures:		
Average starting salary	$3.69	$1.81
Percent with job adjustment problems		
Supervisors' reports	20	33
Graduates' reports	42	40
Supervisors' average ratings[2]	3.32	3.67
Average job satisfaction[2]	4.04	2.88
Average number of jobs since training	1.38	1.86
Percent employed, time of survey	93	89

[1] Percentage distributions may not add to 100 due to rounding.
[2] On a scale of one (low) through five (high).

disadvantaged than nondisadvantaged. They are much more likely to be married, an association with successful outcomes that has been noted in other studies. They concentrate more highly in machining, welding, electronics, and chemical technology than in other training areas, while the less successful graduates are more heavily represented in physical testing and, to a lesser degree, in drafting and mechanical operations. Some relationship between educational attainment and success is discernible, and graduates from the 1969-70 years—whose average starting wages were 20 to 30 cents an hour higher than those of other years—almost by definition appear more frequently in the success column.

The difference in average post-program starting wage between the two groups is striking, amounting to $1.88 per hour—a far greater spread than in the pre-training period. It would appear that, for the low group, the average wage has increased only 3 cents an hour. However, it must be remembered that the pre-program wage relates only to the 31 percent who had jobs before training, while 89 percent held jobs at the time of the survey.

As might be expected, most of the other measures of post-program experience show more favorable results for the high-success group, although supervisors' ratings are tipped in favor of the less successful group.

Less Successful Graduates

The few graduates who had held no job between graduation and the time of the survey (2 percent), and the somewhat larger group who were earning $2 an hour or less at the conclusion of their first job or at the time of the survey (9 percent), are of interest in indicating the apparent reasons for minimal benefits from the program.

Graduates Without Jobs. Of the eight graduates surveyed who lacked any job, one had enrolled in a community college immediately after TAT. The key differences between the other seven and the overall sample appear to be in their marital status and residential patterns. They averaged 22 years of age, the same as the total sample, but five of the seven were single, compared with only a little more than a third of the total sample. Whereas the average graduate had lived in 3.5 residences since graduation, the totally unemployed group continued to live in the same residence. Moreover, the five single trainees were all living with their parents. The researchers surmise that the members of this group were unable to find local jobs relevant to their training skills and resisted moving in order to secure such jobs. Support provided by parents or a working spouse probably made this feasible.

For the rest, this group was made up of four whites and three blacks, and of four disadvantaged and three nondisadvantaged enrollees. Their occupational training areas were electronics (three), machining (three), and welding (one).

Low-Paid Graduates. The somewhat larger group who had worked since graduation, but at low rates of pay, included 14 percent who were unemployed at the time of the survey and 2 percent who were working part time. On the average, they had changed jobs more frequently than the total sample.

Their age distribution was similar to that of the total sample, but only a third were married (compared to 61 percent in the overall sample). Eighteen percent were women (almost four times their frequency in the total sample) and 82 percent were white (compared with 66 percent of the total).

While they expressed willingness to relocate to obtain employment—especially training-related employment—only 5 percent had in fact done so at the conclusion of training. Program staff have concluded that reluctance to move is undoubtedly a factor in relatively poor placement results. Of course, this reluctance to migrate may dissipate in time.

WIN Enrollees. Another commentary on lack of success in TAT is found in the experience of enrolling a group of trainees from a West Virginia WIN project in 1970-71. The group was too small to identify in the sample, but TAT staff report that the training effort was unproductive for these enrollees (for whom academic standards were generally lowered). Many had physical and behavioral problems too severe to be overcome with the resources available to TAT.

APPENDIX B

Course Outlines for TAT Industrial Skill and Technical Training

Occupational

Training Area: Mechanical Trades

Mechanical & Process Operations (MPO) (Total hrs. 1,040)

Base DOT* – 638.281-022

INTRODUCTION TO MECHANICAL TRADES (10 hrs.)

I. Shop terminology
II. Shop equipment
III. Introduction to handtools
IV. Weights, measurements, and standards
V. Identification of materials
VI. Fundamentals of rigging and materials handling

MATHEMATICS (130 hrs.)

I. Arithmetic review and application
II. Introduction to applied formulas
III. Geometry review and application
IV. Fundamental algebra
V. Logarithms and slide rule
VI. Graphing data and trigonometry

PHYSICS (104 hrs.)

I. Mechanics
II. Energy
III. Matter
IV. Electricity

BLUEPRINT READING (36 hrs.)

- Letterings
- Orthographic projections
- The alphabet of lines
- Dimensioning
- Sections
- Screw threads
- Notations
- Auxiliary views
- Assembly and working drawings
- Freehand sketching
- Jigs and fixtures
- Holes
- Castings
- Dovetails, cams, threads
- Pipe drafting and design
- Electrical drawing

Dictionary of Occupational Titles

INDUSTRIAL BEHAVIOR* (12 hrs.)

- Safety
- Drug education
- Career development seminars
- Industrial hygiene
- Role of labor unions

*In addition to these standardized sessions, industrial behavior and practices are integrated into the lab and shop instruction of TAT Industrial Skill and Technical Training.

SPECIALIZED MPO CURRICULUM

The specialized curriculum consists of those courses in which trainees are introduced to specific trades, namely, sheet metal layout, process operations, pipefitting, welding, and millwrighting. The degree of exposure to each of these trades can be varied to suit the needs of a trainee's sponsor or prospective employer.

- Sheet metal shop (100 hrs.)
- Process operations lab (200 hrs.)
- Pipefitting shop (200 hrs.)
- Millwrighting shop (100 hrs.)
- Welding shop (30 hrs.)
- Process operations theory (32 hrs.)
- Pipefitting theory (32 hrs.)
- Welding theory (4 hrs.)
- Sheet metal theory (25 hrs.)
- Millwrighting theory (25 hrs.)

TOPIC OUTLINE

- Materials composition–iron, steel, copper, nickel, chromium, manganese, silicon, tungsten, etc.
- Handtools–measuring, bench, and cutting tools
- Powered handtools
- Shop machinery–band saw, drill presses, pipe threaders, pipe benders, shear, brake, powered roller, punch press, belt sander, grinders, etc.
- Bearings and lubrication
- Sheet metal and gage sizes
- Plane geometry–dimensions, tolerances
- Elbows

- Transition pieces
- Screw pipe—threading, fabrication, and installation
- Pipe measurement and fitting allowances
- Fittings
- Valves, regulators, controls, filters, traps, etc.
- Copper tubing—fitting, brazing, fabrication
- Cast iron soil pipe—fitting, fabrication
- Materials handling and rigging—forklifts, cranes, hoists, etc.
- Process operations—solids, fluids, metals, and gases
- Pressure gages, flowmeters, temperature gages, etc.

Occupational
Training Area: Mechanical Trades
Combination Welding (Total hrs. 1,040)
Base DOT – 812.884-014

WELDING MATH (39 hrs.)

I. Arithmetic review
II. Geometry – Introduction and review
III. Formulas – Introduction

WELDING BLUEPRINT READING (39 hrs.)

- Basic lines
- Basic views
- Notes and specifications
- Dimensioning
- Structural shapes
- Other views
- Notations and standard symbols
- Sections
- Detail and assembly prints
- Welding symbols

WELDING TECHNOLOGY (39 hrs.)

- Introduction to welding (equipment and safety)
- Metallurgy
- Welding machines and accessories
- Electrodes
- Joints and positions
- Inspection techniques
- Certification and code requirements

INDUSTRIAL BEHAVIOR (12 hrs.)

WELDING LAB (911 hrs.*)

- Shielded metal electrode arc welding
  - Plate
  - Pipe
- Gas welding (oxyacetylene)
  - Cutting
  - Welding
  - Brazing
- Specialized tasks (Variable depending on time to completion of basic tasks.)
  - Gas tungsten arc
  - Gas metal arc

*Trainees work toward a fixed criterion performance. Therefore, approximate times are listed.

Occupational
Training Area: Machine Operator
Machining (Total hrs. 1,040)
Base DOT – 601.280-070

MACHINE SHOP MATH (104 hrs.)

- Whole number operations
- Common fraction operations
- Decimal fraction operations
- Direct measurement of units and conversion scales
- Symbolism
- Geometry formulas
- Ratio and proportion
- Indirect measurement
- Applied algebraic formulas
- Geometry
- Trigonometry
- Logarithms

MACHINE SHOP BLUEPRINT READING (104 hrs.)

- Introduction
- Orthographic projection
- The alphabet of lines
- Dimensioning
- Sections
- Screw threads
- Notations
- Projection
- Auxiliary views
- Assembly and working drawings
- Jigs and fixtures
- Holes
- Castings
- Dovetails, cams, gears
- Polish grinds

INDUSTRIAL BEHAVIOR (12 hrs.)

MACHINE SHOP THEORY AND PRACTICE (820 hrs.)

- Introduction to machining
- The machinist trade
- Safety
- Measuring tools
- Handtools
- Layout tools
- Benchwork
- Metal-cutting band saws
- Engine lathes
- Vertical turret lathes
- Grinding machines
- Drill presses
- Shapers
- Planers

- Milling machines
- Boring mills
- Electro-discharge machining
- Dimensional inspection
- Tracer or "duplicator" lathes
- Numerically controlled lathes

Occupational
Training Area: Technician
Industrial Electronics (Total hrs. 1,040)
Base DOT – 003.181-014

ELECTRONICS MATH (156 hrs.)

- Algebra – general numbers and functions
- Equations
- Powers of ten
- Units and dimensions
- Ohm's Law – series and parallel circuits
- Resistance – wire sizes
- Factoring
- Algebraic fractions and fractional equations
- Meter circuits, voltage dividers, and Wheatstone bridge circuits, batteries
- Graphs, simultaneous equations, determinants
- Radicals and exponents
- Quadratic equations and network simplification
- Trigonometric functions, tables, identities, and equations
- Elementary plane vectors and periodic functions
- Alternating currents – series and parallel circuits
- Phasor algebra
- Logarithms
- Boolean algebra and number systems for computers
- Graphical analysis

PHYSICS (104 hrs.)

I. Mechanics
II. Energy
III. Matter
IV. Electricity

INDUSTRIAL BEHAVIOR (12 hrs.)

ELECTRONICS LAB AND THEORY (768 hrs.)

- Basic electricity
- Ohm's Law
- Series circuit, parallel circuits
- Series – parallel circuits
- Network theorems
- D.C. meters
- Conductors and insulators
- Resistors
- Batteries
- Magnetism
- Electromagnetic induction
- Alternating voltage and current
- Inductance
- Inductive reactance
- Inductive circuits
- Capacitance
- Capacitive reactance
- Capacitive circuits
- Alternating current circuits
- Resonance
- Filters
- Electron tubes
- Transistors
- Vacuum tube amplifiers
- Transistor amplifiers

Occupational
Training Area: Industrial Electrician
Industrial Electronics (Total hrs. 1,040)

MATHEMATICS (130 hrs.)

I. Arithmetic review and application
II. Introduction to applied formulas
III. Geometry review and application
IV. Fundamental algebra
V. Logarithms and slide rule
VI. Graphing data and trigonometry

PHYSICS (104 hrs.)

I. Mechanics
II. Energy
III. Matter
IV. Electricity

INDUSTRIAL BEHAVIOR (12 hrs.)

INDUSTRIAL ELECTRICITY – THEORY AND LABORATORY:

BASIC D.C. and A.C. THEORY (first 3 months) (397 hrs.)

- Electricity and electrical circuit
- Batteries
- Kirchhoff's and Ohm's Laws
- Instruments and measurements
- Magnetism
- Electromagnetism
- Capacitance
- D.C. motors
- D.C. generators

ALTERNATING CURRENT

- Alternating current and voltage
- Single phase circuits
- Polyphase systems
- A.C. instruments and measurements
- Synchronous generators
- Transformers
- Polyphase induction motors
- Single phase motors
- Synchronous motors
- Transmission and distribution of electrical power
- Rectifiers

POWER DISTRIBUTION (second 3 months) (397 hrs.)

- Transmission and distribution systems
- Insulators and conductors
- Distribution transformers
- Fuse cutouts
- Voltage regulators
- Switches
- Underground and overhead cables
- Load characteristics

PREVENTIVE MAINTENANCE

- Insulation testing and maintenance
- Batteries
- A.C. generators
- A.C. motors
- Transformers
- Regulators and current-limiting reactors
- D.C. generators and motors
- Commutator, slip-ring, and brush maintenance
- Trouble-shooting and emergency repairs of A.C. and D.C. machinery

NOTE: Electrical safety, work practice, blueprint reading, and schematic reading will be taught throughout the 6 months.

Occupational
Training Area: Technician
Physical Testing (Nondestructive) (Total hrs. 1,040)
BASE DOT – 019.281-014

MATHEMATICS (130 hrs.)

I. Arithmetic review and application
II. Introduction to applied formulas
III. Geometry review and application
IV. Fundamental algebra
V. Logarithms and slide rule
VI. Graphing data and trigonometry

PHYSICS (104 hrs.)

I. Mechanics
II. Energy
III. Matter
IV. Electricity

INDUSTRIAL BEHAVIOR (12 hrs.)

TECHNICAL THEORY AND LABORATORY – PROPERTIES OF MATERIALS (117 hrs.)

- Density testing
- Hardness testing – Mho scale
- Tensile and compression testing
- Impact testing
- Fluorescent liquid penetrant testing
- Visible dye penetrant testing
- Magnetic particle testing for surface-subsurface defects

PHYSICAL TESTING – ULTRASONICS (280 hrs.)

- Theory of sound
- Industrial applications
- Generation of ultrasonic sound by transducers
- Wave propagation characteristics in various media
- Sound attenuation
- Resonance
- Systems and test methods
- Effect of specimen on wave propagation
- Resonance test equipment, instruments, accessories
- Transducers
- Reference and calibration blocks
- Generators and induction equipment
- Contact testing – applications
- Immersion testing – applications

METALLOGRAPHY (117 hrs.)

- Introduction to metallography
- Metal structure
- Crystallization or solidification
- Slip and plastic deformation
- Recrystallization
- Hot and cold working
- Twinning
- Alloy and constitutional diagrams
- Heat treatment and properties of steel and iron
- Specimen preparation
- Photography applications
- Report writing

RADIOGRAPHY (280 hrs.)

- Radiation safety
- Theory of film processing
- Basic radiation physics
- Interaction of X-rays and gamma rays with matter
- X-ray penetration relationships
- Geometric principles and light relationships
- Factors governing exposure
- Scattered radiation
- Isotope radiography theory
- Equipment operating procedures
- Exposure and radiographic technique
- Radiographic configuration shots
- Effects of kilovolt and milliampere shifts

RADIATION SAFETY TECHNICIAN
TRAINING PROGRAM (3-Week)

Course	Hours		
	Lecture	Laboratory	Field
I. Basic Physical Concepts			
A. Review of Physics and Math	4	3	
B. Review of Radiation Physics	11	5	
II. Health Physics Principles			
A. Philosophy of Radiation Protection	0.5		
B. Radiation Standards	1		
C. Recommendations and Regulations	2		
D. Biological Basis for Radiation Guidelines	0.5		
E. External Hazards	0.5	2	
F. Internal Hazards	0.5		
III. Health Physics Instrumentation			
A. Survey Instruments	5		
1. operation		5	
2. calibration		1	5
3. maintenance		1	
B. Laboratory Counting Equipment		12	
IV. Radiation Dosimetry			
A. Personnel Monitoring	1.5	3	
1. internal dose assessment			
2. external dose assessment			
B. Standards for X and γ Measurements	1.5	2	
C. Dosimetry of Particulate Radiation	2	2	
D. Dosimetry of Neutron Radiation	1.5		
E. Accident Dosimetry	1.5	2	2
V. Radiation Control Techniques			
A. Laboratory Design and Ventilation	1.5		2
B. Protective Clothing and Equipment	1.5		
C. Personnel and Facility Decontamination	1.5	1	
D. Control of External Hazards	3	2	
E. Radiation Shielding	4	3	
VI. Medical Health Physics			
A. Safe Practices in Use of Medical Radioisotopes			
B. Safe Handling of Radiopharmaceuticals			
C. Diagnostic X-rays			
D. Therapeutic Uses of Radiation			
VII. Environmental Monitoring	1.5		
A. Air Sampling and Analysis			
B. Water Sampling and Analysis			
C. Specific Applications			
VIII. Handling of Emergency Situations			
A. Emergency Planning	2		
B. Simulated Emergency Exercises			6

RADIATION SAFETY TECHNICIAN
TRAINING PROGRAM (3-Week)—Continued

Course	Hours		
	Lecture	Laboratory	Field
IX. Applied Health Physics Field Training			
A. Reactor Surveys			
B. Laboratory Surveys			
C. Hot Cell Surveys			
D. Accelerator Surveys			
E. Medical and Industrial Radiography Surveys	3		4
X. Time in Review and Exam Sessions	6		
TOTALS	57	44	19
GRAND TOTAL . . . . . 120 hrs.			

RADIATION SAFETY TECHNICIAN
TRAINING PROGRAM (10-Week)

Course	Hours		
	Lecture	Laboratory	Field
I. Basic Physical Concepts			
A. Review of Physics and Math	5	5	
B. Review of Radiation Physics	5	7	
II. Health Physics Principles	3.5		
A. Philosophy of Radiation Protection	4		
B. Radiation Standards	4.5		
C. Recommendations and Regulations	6.5		
D. Biological Basis for Radiation Guidelines	7	3	
E. External Hazards	6	10	
F. Internal Hazards	3	3	
III. Health Physics Instrumentation			
A. Survey Instruments			
1. operation	6	7	16
2. calibration	3	3	2
3. maintenance	2	1	3
B. Laboratory Counting Equipment	4	18	
IV. Radiation Dosimetry			
A. Personnel Monitoring	2.5	4	
1. internal dose assessment	4	4	
2. external dose assessment	6	20	
B. Standards for X and γ Measurements	1	3	
C. Dosimetry of Particulate Radiation	6	8	
D. Dosimetry of Neutron Radiation	5	5	
E. Accident Dosimetry	3		2
V. Radiation Control Techniques			
A. Laboratory Design and Ventilation	1	2	
B. Protective Clothing and Equipment	1	2	4
C. Personnel and Facility Decontamination	1	3	
D. Control of External Hazards	2	4	
E. Radiation Shielding	3	6	
VI. Medical Health Physics			
A. Safe Practices in Use of Medical Radioisotopes	2	6	
B. Safe Handling of Radiopharmaceuticals	2	3	
C. Diagnostic X-rays	1	2	
D. Therapeutic Uses of Radiation	1	2	
VII. Environmental Monitoring			
A. Air Sampling and Analysis	2	3	
B. Water Sampling and Analysis	2	3	
C. Specific Applications	2	5	
VIII. Handling of Emergency Situations			
A. Emergency Planning	2	3	
B. Simulated Emergency Exercises			6

RADIATION SAFETY TECHNICIAN
TRAINING PROGRAM (10-Week)–Continued

	Course	Hours		
		Lecture	Laboratory	Field
IX.	Applied Health Physics Field Training			
	A. Reactor Surveys	1.5		4
	B. Laboratory Surveys	2	2	
	C. Hot Cell Surveys	1		1
	D. Accelerator Surveys	1.5		4
	E. Medical and Industrial Radiography Surveys	2		3
X.	Time in Review and Exam Sessions	41		
XI.	Individual Projects Related to Health Physics	50		
	TOTALS	208	147	45

GRAND TOTAL . . . . . 400 hrs.

Occupational
Training Area: Technician
Industrial Drafting (Total hrs. 1,040)
Base DOT – 007.281-014

MATHEMATICS (130 hrs.)
I. Arithmetic review and application
II. Introduction to applied formulas
III. Geometry review and application
IV. Fundamental algebra
V. Logarithms and slide rule
VI. Graphing data and trigonometry

PHYSICS (104 hrs.)
I. Mechanics
II. Energy
III. Matter
IV. Electricity

INDUSTRIAL BEHAVIOR (12 hrs.)

DRAFTING AND PROGRAMMING (794 hrs.)
- Lettering fundamentals
- Instruments and materials
- Orthographic projections
- Planes of projections
- Multi-view projections
- Geometrical constructions
- Dimensioning
- Sectional and conventional practices
- Auxiliary views
- Revolutions
- Complex auxiliary views
- Pipe drafting and design
- Isometric drawings of complex machines
- Electrical drawing
- Fabrication processes
- Engineering materials – properties, uses
- Numerical control processes
- Automatically Programmed Tools (APT) language
- Parts programming and debugging
- True position dimensioning
- Value engineering analysis

FUNCTIONAL INDUSTRIAL TRAINING (FIT) UNIT – PADUCAH, KENTUCKY

The following are basic course outlines indicating the approximate number of hours allocated to each activity.

INSTRUMENTATION AND ELECTRICITY (1,040 hrs.)
Electricity (121)
Electronics (121)
Physics (174)
Math (214)
Slide Rule (9)
Cooke Book (189)
Math Problems (16)
Sketching (15)
Shop (252)
Electricity (86)
Electronics (46)
Instrument (86)
Tool Usage (34)
Holidays (32)
Orientation (1)
Safety and First Aid (10)
Instrumentation (100)

NOTE: There has been an extension of 13 weeks training to the Industrial and Electricity training area. FIT staff indicate that the additional time is distributed over the majority of the training area topics, and does not include additional subject matter to be taught separately.

MAINTENANCE MECHANICS (Total hrs. 1,040)
Welding instruction (22 weeks) (880)
Motor alignment (8)
Shop math (50)
Blueprint reading (20)
Hand and power tools (including forklifts) (40)
Safety (8)
Job seminar (8)
Scarfing and burning (26)

The 880 hours (22 weeks) of welding instruction and the 160 hours (4 weeks) of additional subject matter in the Maintenance Mechanics course are taught concurrently. The motor alignment subject area is introduced after the trainee has completed the plate and pipe test.

All Maintenance Mechanics in the UCCND-Paducah Plant are certified welders; thus, the mechanic does not have to stop work to bring in a welder to complete a specific welding task. Both trades are incorporated in the one individual. It is for this reason that the mechanic curriculum is heavily oriented toward welding.

AUXILIARY SERVICES

Developmental Reading

The objective of the developmental reading program is to ensure that reading-deficient trainees reach the reading level required to achieve vocational training success. This objective is met by (1) diagnosing their reading strengths and weaknesses; and (2) from these findings, planning a corrective reading program to overcome the weaknesses and reinforce the strengths.

To accomplish the program goals, trainees deficient in reading are placed in 1 of 4 ability groups based on

diagnostic testing. The trainees are helped to reach a reading level that permits them to easily handle required reading materials.

While the development and growth of reading skills is a lifelong process, the reading program helps to build a solid foundation of basic reading skills which permit future development.

General Education Development Learning Laboratory

The General Education Development (GED) program was established to provide trainees with an opportunity to receive a high school diploma.

The purpose of GED is to help trainees prepare for the General Education Development test by (1) diagnosing their educational deficiencies and (2) concentrating on overcoming those weaknesses. Since the trainees have varying problems, the program is set up in laboratory fashion to allow for individualization. The individualization concept allows students to progress at their own rate and to concentrate on those subjects in which a deficiency exists.

An equivalency diploma, which is honored by industry, colleges, and the military, is awarded by the State Board of Education to trainees who pass the GED test.

Trainees without high school diplomas are provided study time as scheduled with training areas.

Tutoring

Special tutoring in math beyond classroom instruction is provided by qualified tutors.

Trainees with poor backgrounds in math need individualized attention. The security of a one-to-one ratio creates confidence, motivation, and development of skills in math. Volunteer and staff tutors provide such a framework.

LISTING OF BASIC TEXTS–
TAT INDUSTRIAL SKILL AND TECHNICAL TRAINING

Course title	Grade level	Basic texts
MECHANICAL TRADES:		
Mechanical/process operations		
Introduction to mechanical trades	6-12	*ABC's of Hand Tools, The Tools and Rules for Precision Measurement,* General Motors.
Sheet metal	6-12	*Precision Sheet Metal,* Howard W. Sams; *Sheet Metal Series,* Delmar Pub.
Process operations	6-12	*Basic Unit Operations; Unit Operations,* Wiley and Sons. *Chemical Process Equipment,* Reinhold.
Pipefitting	6-12	*Plumbing I,* Delmar Pub.
Millwright	6-12	*Modern Metal Working,* Goodheart-Wilcox; *Machinery's Handbook,* Industrial Press.
Welding shop	6-12	*Blueprint Reading for Welders,* Delmar; *Welding Handbook,* American Welding Society.
Blueprint reading and sketching	10	*Basic Blueprint Reading and Sketching* (Olivo & Payne), Delmar Pub.
Combination welding		
Welding technology and practice	8	*Welding Skills and Practices* (Giachino, Weeks & Brune), American Technical Society.
Welding blueprint reading	8	*Blueprint Reading for Welders* (Bennett & Sily), Delmar Pub.
MACHINING AND INSPECTION:		
Machine shop theory and practice	9	*Shop Theory* (Anderson & Tatro), McGraw-Hill.
Machine shop blueprint reading	8	*Elementary Blueprint Reading for Beginners in Machine Shop Practice,* Delmar Pub.
	9-12	*Advanced Blueprint Reading for Machine Trades,* Vol. 1, Delmar Pub.
TECHNICIAN:		
Industrial electricity	10-13	*Swope's Lessons in Practical Electricity* (Haussmann), D. Van Nostrand.
		Maintenance Hints, Westinghouse Electric Corp.
		Home Wiring, H. P. Richer.
Industrial electronics	12	*Basic Electronics* (Grob), McGraw-Hill.
Physical testing		
Ultrasonics	12-13	*Nondestructive Testing, Ultrasonic Testing,* Programmed Instruction Handbook Pl-4-4, General Dynamics.
Metallography	11	*Metallographic Specimen Preparation* (R. V. Gray), Union Carbide Corporation prepared material, ORNL.
Radiography	12-13	*Nondestructive Testing Radiography,* Programmed Instruction Handbook Pl-4-6, General Dynamics.
Properties of materials	9-10	*Introduction to Physical Metallurgy* (Avner), McGraw-Hill.
Chemical technician	8-13	*Organic Chemistry,* Houghton-Mifflin; *Modern Chemical Technology,* American Chemical Society.
Industrial drafting	10-13	*Technical Drawing* (Giesecke, Mitchell, Spencer & Hill), Macmillan.

LISTING OF BASIC TEXTS–
TAT INDUSTRIAL SKILL AND TECHNICAL TRAINING–Continued

Course title	Grade level	Basic texts
TRADE–RELATED MATH:		
Basic math	7	*General Trade Mathematics* (Van Leuven), McGraw-Hill.
Introduction to applied formulas	8	*Practical Mathematics* (Palmer, et al.), McGraw-Hill.
Geometry: Introduction and application	9-10	*Practical Mathematics* (Palmer, et al.), McGraw-Hill.
Fundamentals of applied algebra	11-12	*Practical Mathematics* (Palmer, et al.), McGraw-Hill; *Intermediate Algebra for College Students.*
Advanced topics in related math	12-13	*Practical Mathematics* (Palmer, et al.), McGraw-Hill; *Technical Mathematics & Calculus* (Rice & Knight), McGraw-Hill.
Machine shop math	8-10	*Machine Shop Mathematics* (Olivo), Delmar.
	12	*Practical Shop Mathematics* (Wolfe & Phelps), McGraw-Hill.
Electronics math	9-13	*Basic Mathematics for Electronics* (Cooke), McGraw-Hill.
Welding math	10	*General Trade Mathematics* (Van Leuven), McGraw-Hill.
Chemical arithmetic	11-12	*Chemical Artthmetic* (Oberkrieser), D. Van Nostrand.
TRADE-RELATED SCIENCES:		
Physics Mechanics Energy Matter Electricity	9-12 (Adjusted according to class group and individual needs)	*Modern Physics* (Williams, et al.), Holt, Rinehart, and Winston. *Fundamentals of Applied Physics* (Olivo and Wayne), Delmar. *Science: A Key to the Future* (Barnard, et al.), Macmillan. *Fundamentals of Physical Science* (Krauskopf and Beiser), McGraw-Hill. *Programmed Textbooks General Science:* *Sound, Light* *Electricity and Communications* *Work and Machines* (Schaefer, et al.), TMI-Grolier.
INDUSTRIAL BEHAVIOR	8-12	Information and materials developed by TAT staff, plus filmstrips and records from Guidance Associates, Inc., Pleasantville, New York; films from University of Tennessee. Small-group seminars, "cluster" counseling, "staffing," and special-topic sessions as required.
DEVELOPMENTAL EDUCATION SERVICES:		SRA Reading Kits IIIa, IcRFV Books: Basic Language Skills Program Book 160, Book 900A.
REMEDIAL:		Craig Reading Machines, Sullivan Programmed Readers, Mott Language Series.
Word analysis, discrimination affixes, comprehension, written communication skills	3-7	Allied Education Council, Basic English Skills Book 7, Houghton-Mifflin Company.
GED:		
English, math, social studies, science – for high school equivalency	8-12	*Job Corps Advanced General Education Program* (Experimental Edition 1967; copyright 1968, Ed. Performance Systems, Inc.), Office of Economic Opportunity; plus selected program materials.

APPENDIX C
Case Histories

Paul entered TAT in October 1969, under the sponsorship of the Tennessee Rural CEP. Initial testing revealed substantial educational deficiencies, and the requirement for sixth-grade reading and math achievement was waived in his case. His eight grades of formal schooling had not prepared him for reading even simple instructions in the programmed self-help material in the GED (high school equivalency) program.

He was immediately sent to the company's medical unit for eye tests and to the University of Tennessee Hearing and Speech Center for hearing tests, but no physical problem was found. A special test, the Wechsler Adult Intelligence Scale, indicated a below-average score of 81 and a performance score of 99; but the trained psychologist who administered the test detected Paul's exceptional desire to learn. He was assigned to the Mechanical Operations course.

As a next step, a group of instructors and counselors discussed—among themselves and with Paul—the pros and cons of keeping him in the program. He convinced them of his willingness to educate himself by night study and extra work. His remark, "You ain't gonna give up on me like the rest of 'em are ya?" re-enforced the decision to work with him.

Although TAT is not a program for illiterates, it has been an experimental program; and working with Paul was regarded as an opportunity to test various methods and approaches which might be used in working with other trainees who are educationally deprived.

For 2 months Paul required a completely individual schedule. His instructor set up a shop curriculum for him and taught him while other trainees were in math classes. Arrangements were made for him to attend adult basic education evening classes in Oak Ridge, and TAT staff instructors supervised his remedial math and reading assignments.

Learning to read was a major hurdle for Paul, along with improving his poor listening and writing skills. However, in a short time he learned to recognize more than 200 words, then to read simple books. He was soon able to work under the instruction of an older trainee-teacher, supervised by the reading instructor. Four months after joining TAT, he was enrolled in the special reading class for slow readers.

Paul's math level rose more rapidly. From minimal competence with addition and subtraction, he progressed to success with the four basic computations in whole numbers, fractions, and decimals. He was able to enter the regular Mechanical Operations math course in just 5 months.

Paul completed the TAT program in 11 months, rather than the usual 6 months, and was placed with a Nashville firm in a training-related job. Thus the combination of a determined trainee, a highly motivated and qualified staff, and extra time and effort, paid off in "turning around" a seriously disadvantaged young man.

Paul was not a typical TAT enrollee. The following are brief accounts of the more nearly representative experiences of three other young people who graduated from TAT.

George entered TAT in October 1968 and completed the program in a normal 6 months. When he started training, he was 22 years old, married, and a veteran. He was also unemployed and lacked a high school diploma—a handicap which he overcame through TAT's program of preparation for the GED diploma.

George chose to learn welding and chalked up average grades both in shop work and in related academic subjects. Upon completion of training he was hired by Nuclear Division, Union Carbide Corporation, as a process operator at the Oak Ridge Y-12 plant. Although this initial job was unrelated to his training, he was able to bid successfully on a welding job that opened 2 years after he joined the company's work force. After another 2 years, the former trainee returned to TAT as a demonstration welder and instructor's aide. George sees this latest experience as buttressing his earlier learning and enhancing his usefulness to Union Carbide.

Jim began TAT training in Physical Testing in April 1970 and 6 months later was hired to work in the Y-12 plant as a radiographer aide. He had come to Oak Ridge under CEP sponsorship from Chattanooga, where he graduated from high school with better-than-average grades. Like George, he is a veteran. Also like George, he returned to TAT as an instructor's aide in his specialty. Upon completion of this 6-month assignment, he went back to the plant with a promotion to radiographer, first class. A subsequent transfer to the Mechanical Inspection Department reflects continuing advancement and skill development.

Mary, a young divorcee with a child, was trained in Physical Testing, finishing in September 1972. While in TAT, she obtained a GED diploma. She also caught the attention of a visiting IBM recruiter and was hired for the company's customer engineer training program. (IBM customer engineers service typewriters and

machines rented to businesses.) In the IBM program, she placed 10th among 8,000 trainees nationwide—and on her new job, has sometimes repaired typewriters for TAT. After some further field experience with IBM, the company's representatives say, she will be trained for a management position.

For further information on the TAT programs, write:

Training and Technology
Oak Ridge Associated Universities
P. O. Box 117
Oak Ridge, Tennessee 37830

Phone: (615) 483-8411

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